THE COMPLEXITY OF LEARNING: RELATIONS ALL THE WAY DOWN

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CERTIFICATE OF AUTHORSHIP/ORIGINALITY

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Signature of Candidate

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You were in luck – there was a forest.
You were in luck – there were no trees.
You were in luck – a rake, a hook, a beam, a brake,
a jamb, a turn, a quarter inch, an instant.
You were in luck – just then a straw went floating by.

Wisława Szymborska, *Could Have*

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ABSTRACT

This is a conceptual thesis about how both learning in relation to professional practice, particularly learning *from* practice, and the production and use of professional knowledge, can be understood. The work of the thesis is an attempt to address the issue of how to conceptualise an onto-epistemological framework for inquiry in the field of social sciences that consists of learning, practice, learning from practice and producing and using knowledge; a framework that fits more productively with practitioners' experience in these areas than the one we currently use.

The traditional ontological perspective, that frames the way in which concepts such as practice and learning are conceptualised, imposes significant limitations on their understanding and use. This traditional framework is substantialist in form. That is, it reflects a model of the world in which substances or entities have prime ontological significance. Because of this, the relations between entities are commonly either treated themselves reductively as additional entities, or are ignored. I argue that it is this relational reductionism of the traditional substantialist ontology that is problematic when considering human processes such as practice and learning.

The thesis has its experiential origins in the lack of fit between espoused theories of learning and theories-in-use as related to professional practice. To illustrate this I use the claims of Evidence-based Medicine to function as a theory of medical practice and as a medical epistemology. I argue that its limitations in both areas follow from its development within the traditional substantialist, or entity-based, framework which shapes these claims. The limitations of Evidence-based Medicine serve as an example of the way in which applying relationally reductive manoeuvres to the complex relations of lived experience, while to some degree a necessary aspect of all human social functioning, is problematic if not done in a critical or reflective manner.

The body of constructs and theories known as 'complexity' offers a more encompassing onto-epistemological framework for considering human processes. It does so because it is relation-based. In such a framework, systems and processes are conceptualised as being constituted by their relations, rather than built up of their composite entities. In

this thesis I draw on several already current theories and bodies of concepts which are consistent with a complexity perspective, to support the use of complexity as a framework in re-formulating learning and its relation to practice.

The first of these is the pragmatist philosopher John Dewey's formulation of living functionality which has 'trans-actional' relations as a central feature. I argue that if these relations are understood as an exemplar of complex living relations, then complexity has a capacity to account for the generativity (the emergence of the radically new) and the indeterminacy (the unknown unknowns) of human functioning, neither of which can be done within the traditional substantialist framework.

The second is a body of concepts derived from psychoanalytic thinking and other theories of psycho-biological functioning which relate to human affective functioning. Human affective needs act as a driver of social processes and activities and human experience that is affectively shared between individuals and socially processed. produces meaning. What these concepts have in common is an understanding of human psycho-social function as having a relational basis at multiple levels, for which trans-actional relating can function as a model. These psycho-biological concepts, with sociologist Niklas Luhmann's theories of social functioning as emerging from inter-personal communication, allow for distinctions to be made between aspects of human functioning at biological, psychological and social 'levels', levels that are both differentiated and mutually dependent, allowing a re-formulation of learning, its relation to practice and the production of knowledge.

With these theories in mind, I take the 'co-present group' as central to an exploration of how practice and learning might look from a complexity perspective. The human co-present group is a group, such as a work group, where individuals are each known to the others as *specific* individuals. It functions as a complex system (the group) of complex systems (the participating individuals). I argue that the co-present group functions as the site of both human learning and of the origin, development and modification of all social and cultural phenomena, both of which depend on the group processing of human affective states.

Because humans have the capacity to 'share' the processing of affective states with other specific individuals, this processing function is not co-terminous with the biological human individual but can be considered as an aspect of co-present group's functionality. Learning, for the individual, emerges from co-present group processes through the bio-psychological individual. In contrast, and following the work of sociologist Niklas Luhmann, 'communications' emerge from complexity-reducing interactions *between* individuals, thus having a social origin, and are available for elaboration into social and cultural phenomena through repeated use and re-use in multiple contexts.

I draw conclusions to this thesis in two areas. The first is that if complexity is understood broadly as being based on complex living relations as exemplified by John Dewey's trans-actions, it can function as an onto-epistemological framework for inquiry into living human processes. The second area, which follows as a consequence of using such a framework, is that human processes are re-conceptualised in functional terms and can be seen as being based in, and emergent from, co-present group function. This, in turn, has consequences for how we understand learning, its relation to practice and the production and use of knowledge.

CHAPTER 1 - INTRODUCTION

In this introductory chapter I will address two areas of this work. Firstly I will cover the scope and main arguments of the thesis, in summary form and organised by the chapter headings of the thesis itself. Then I will outline my own introduction to the subject area, an introduction that has its origins in my experience as a medical practitioner and the difficulties I have had with how to make sense of the role of learning in relation to that practice. My experience with the subject of learning in a professional context has raised issues of how to conceptualise knowledge, such as that of a community of practice, how to conceptualise the relationship of such knowledge with practice and how to understand the learning that depends on practice for its emergence. Learning through the process of practice is something that is known experientially by all practitioners, engaging in any form of practice, but it is largely overlooked in discourse about learning and about practice and it is this issue of 'learning from practice' that is central to this thesis. I will finish this chapter with an introduction to Evidence-based Medicine, which is the focus of Chapter 2.

1.1 THE SCOPE AND CENTRAL ARGUMENTS OF THE THESIS

The arguments and findings of the thesis form its central chapters, Chapter 2 to Chapter 7. These are:

Chapter 2 Evidence-based Medicine

In this chapter I review of the body of theory known as 'Evidence-based Medicine', which has been the progenitor of the construct 'evidence-based practice', in order to illustrate some of the limitations of the traditional way of conceptualising practice and learning. Evidence-based Medicine provides a rather extreme, formalised example of these conceptualisations, making claims to be both a medical epistemology and a model of professional practice based on that epistemology. However when examined it can be seen that its definition of practice, based on a narrowly defined, retrospectively focused epistemology, is descriptive neither of current practice nor of any form of practice that could actually be attempted by a practitioner. It is a claim of this thesis that Evidence-

based Medicine functions as a term for the varying uses of research findings by clinicians, and as a rhetorical device which has been taken up and used by organisational and administrative functions in medicine and is spreading to equivalent areas in other fields.

Examination of Evidence-based Medicine's basic tenets reveals that they are characterised by reduction at multiple levels. Standardisation of practice is presented as an aspect of quality; variation in the processes of medical practice are understood as error; human judgement of the practitioner is regarded only as a source of error and practice itself is reduced to a mechanistic choosing of pre-prescribed actions, based on a reductive definition of what should constitute medical knowledge. In Evidence-based Medicine there is a lack of recognition of medical practice as a live process. Instead, the possession of a product (the findings of clinical research) is substituted for medical practice as a process and with this substitution the possibility of any concept of process-based learning disappears.

I will argue that the limits of Evidence-based Medicine as an epistemology and as an account of practice can be traced to the reductiveness inherent in the underlying entity-based or substantialist onto-epistemological framework in which it is based.

Chapter 3 Relations and Systems

Some degree of reduction is an essential aspect of human processes, from formulation of conscious thoughts, through engagement in social interactions, to the making of conceptual or material social products. However, the onto-epistemological framework which largely underpins current social inquiry both focuses on entities at the expense of relations and treats relations, where addressed, reductively as entities. This latter form of reduction can be understood as a *relational* reduction where, in the process of modelling, the complex relations of lived human life are reduced to the relations of Newtonian mechanics.

In the work of the pragmatist philosopher John Dewey, life and its processes, in contrast, are modelled from within a relational framework, as a relational process; a

process of organism-environment co-ordination, where time, the asymmetrical dimension, is understood as critical. Dewey, in his late work with Arthur Bentley, delineates forms of relations characterised by differing degrees of reduction and comments on their function. He separates what he calls a 'trans-actional relation', characterising the organism-environment co-ordination of life, from the more reduced forms of relation, 'inter-actions' and 'self-actions' (I will leave aside Dewey's self-actions, which are the relations of disengaged self-propelling entities, beyond epistemological reach). Inter-actions are the relations of Newtonian mechanics and of logic, where the relation itself is determinate, in that it does not change during the processes in which it is engaged. In Dewey's conceptualisation, inter-actions are a human production for use in communication and as tools in inquiry. It is this reduced formulation that is currently understood as the meaning of the concept 'relation' as it is used across most fields of inquiry, the social sciences as well as the natural sciences. In contrast, Deweyan trans-actions can be said to be exemplars of the relations of living organisms. It will be an argument of this thesis that it is because trans-actional relations encompass indeterminacy, they can serve as a model for the complex relations that underpin the emergence of the generative or creative processes of life and human practices. They can thus provide the basis for models of learning and practice that are less reductive than are traditional models which are based on the Newtonian relations of a substantialist or entity-based framework.

In a very broad sense, relations implicate systems. Wherever there are relations, what you have can also be conceptualised as a system, and in turn, systems are characterised by internal relations. It can be seen that Dewey's account of different forms of relation, trans-action and inter-action[1] respectively, provides the basis for an account of qualitatively different aspects of systems functioning, living and non-living aspects. A further aspect of system functioning that is relevant to this thesis is that of autopoietic functioning, originally conceptualised by biologist Humberto Maturana as the feature of living organisms that allows the organism to maintain its integrity while being

[1] As there is no way in common parlance to differentiate between 'inter-action' and 'trans-action' I will use Dewey's hyphenated form of the terms where I am referring to his definitions of these relations through the thesis.

selectively open to the external world for supplies of energy or food. This concept has been adapted by sociologist Niklas Luhmann for understanding the functioning of human and social systems as elaborated on in Chapter 5, 'Complexity and the Social'.

Chapter 4 Complexity

The field of theories known by the shorthand of 'complexity theory' or 'complexity' offers a framework within which to consider systems produced by 'complex' or trans-actional relations. These complex systems are systems of process or functionality. They can be conceptualised as being structured by their internal relations rather than built up of their constituent entities.[2]

Almost all current writing about complexity in the social sciences relies on theory from fields of the natural sciences. Here, although complexity is understood as being relation-based, and non-linear, it is ultimately, at least in theory, amenable to algorithmic analysis and thus is determinate. This perspective of complexity, 'deterministic' complexity, belongs within a substantialist framework and thus has limitations as a tool for inquiry in the social sciences. Conceptualisation of relations as Newtonian relations means that the distinction that Dewey makes, between inter-actions and the trans-actional relations of living organisms, is lost. Inquiry involving human systems, characterised by complex, indeterminate relations, requires a less reductive conceptualisation of complexity. In this thesis I argue for the conceptual use of a broader or 'general' complexity perspective.

Deterministic complexity is based in the mathematics of chaos theory and uses concepts derived from within the range of scientific disciplines from which it has emerged in recent decades. This produces a version of complexity based on a reductive conceptualisation of relations. Use of this form of complexity has a place in theorising in the natural sciences; in the social sciences its usefulness is limited to inquiry into macro level phenomena, such as population-based studies of crowd behaviour, stock-

[2] In this thesis I will use the terms 'complex relations' and 'trans-actional relations' interchangeably on the basis of their shared characteristics of being relations of living organisms, with a central indeterminacy that allows for generativity. I also refer to Dewey's trans-actional relations as an *exemplar* of complex relations, because in his work with Bentley he teases a two-party relationship out of a field of complex relations in order to characterise such relations.

market processes or urban development patterns. In these forms of inquiry the individuals who comprise the group or system that is the subject of the inquiry can be handled reductively as objects or entities. Here the loss of information entailed in such a reductive conceptualisation of the individual is not significant to the inquiry. However, deterministic complexity is inadequate for use in situations where it *is* of significance to the inquiry that the individuals who comprise the group or system being studied be recognised as subjective agents, such as is seen, for example, in inquiry into education or health systems at the level of service delivery. For meaningful inquiry, we need to be able to use a less reductive conceptualisation of relations and of the systems they create. So, a further argument of this thesis, related to the argument about relations above, is that complexity needs to be understood more broadly than it is currently. A less reductive conceptualisation of complexity, which has been given the name, taken from the work of French philosopher of sociology Edgar Morin, of 'general complexity' (Heylighen, 2006), encompasses both systems derived from complex, trans-actional relations and, nested within them, systems derived from Newtonian relations, the result of relationally reductive human processes.

Complexity understood in this less reductive way opens up the possibility of re-conceptualising a range of issues relevant to the social sciences. Most centrally it facilitates an understanding of that aspect of complexity function known as 'emergence'. This is the generative capacity of living systems to produce emergent features which are radically or qualitatively new, but are not random and which have limits, as their functioning is constrained by the functioning of the 'parent' system from which they emerge. Emergence can be understood as the relation between a 'parent' system and its 'offspring' system, where each is characterised by irreducibly different underlying relations. Conceptualisation of emergent functioning allows for differentiations to be made between the complex systems of the natural world, living biological systems, bio-psychological systems and the social systems produced and maintained by reduced aspects of human interactions. In the two following chapters of the thesis I consider how complexity can be used to differentiate social and psychological *functionality*, in order to describe the relations between the two. (A

distinction between 'psychological' and 'social' made on the basis of functionality does not follow a *substantialist* differentiation. So, psychological functioning can be understood as not wholly co-terminous with the individual physical body and there are some forms of social interaction that can be understood as a 'shared' psychological function.)

Chapter 5 Complexity and the Social

The systems theory of social functioning of the sociologist Niklas Luhmann is consistent with a complexity perspective. Luhmann makes a number of significant distinctions that differ from distinctions made in substantialist framework social theories. The first distinction is one between biological functioning, which he describes as processing life, and the psyche (his term) and social systems, both of which he describes as having the function of processing meaning. The other distinction is that between society, as a whole, with the institutions and organisations derived from it, and the bio-psychological individual. Each of these two systems is informationally closed and so functions self-referentially. Together they constitute distinct and irreducible but mutually dependent systems, the function of both being the processing of meaning. Luhmann differentiates between social systems and what he calls 'interaction systems' (co-present groups of individuals where individuals are known to each other as *specific* individuals). This differentiation is based on a *functional* differentiation between social and psychological forms of processing meaning. The social processing of meaning is based on the 'communicative process', which is an inter-personal process of iterative moves that produces the relationally reduced 'communications' (his term) from which all social phenomena are ultimately derived. The psychological processing of meaning is based on socially-mediated (by the co-present group) but ultimately bio-psychological processes (processes of minds). These two forms of processing meaning may occur as the one process, in a co-present group, however they are *functionally* distinct because Luhmann has chosen to differentiate between the relations that characterise each process. The significance of Luhmann's work for this thesis lies in the relational basis of his theories, which are informed by complexity; in his choice of meaning-creation as the central function of human social life, and in the way he makes a place for

individuals in co-present interaction with each other as the source of the social 'energy' that creates and powers all social processes.

Chapter 6 Complexity and the Psychological

In this chapter, using some aspects of British Object-relations psychoanalytic theory that are supported by current developments in neurobiology, I review the way in which the first learning, the process of 'learning to be human', is both a profoundly relational process and a bio-psychologically-based process. It involves an infant and adult carer relationship, the earliest co-present group experience for the infant, which is based on the sharing of aspects of affective functioning such that psychological function can be said to be temporarily shared, a process which is implicated in the biological shaping of the infant's brain as part of bio-psychological development. The significance for the thesis of this chapter is twofold. It is the illustration of the relational and affective bases of bio-psychological functioning in human developmental processes which underpin the subjective experience of meaning, and hence of learning, throughout life. And, just as functionality in the social world, as illustrated by Luhmann's conceptualisations, is characterised by systems of relations created by distinctions, so the psychological functioning of the individual is characterised by the creation/discovery of such relations, a process that is both internal to the mind and totally dependent on social relations.

Chapter 7 Complexity and Learning

In this chapter I review my conclusion that general complexity can be used as a more comprehensive relation-based onto-epistemological framework for inquiry in the social sciences than the currently used substantialist framework. Such a framework allows for useful distinctions to be made on the basis of functionality rather than substance, differentiations that include that of bio-psychological and psycho-social functionality, each based on irreducibly differentiated but mutually dependent, complex systems. Learning can be understood as the change in bio-psychological functioning of the individual participant in co-present group functioning; functioning that involves the group processing of affective states and the communicative interactions by which meaning is attributed to the individual's and groups' experiences of social phenomena.

This attributing of meaning is a group function, not a function of an individual alone. The bio-psychological individual will have his or her own interpretation of that meaning, but it will be constructed as a variation on the theme of the group meaning because in complexity terms the individual here is conceptualised as a *functional aspect* of the group rather than as an individual *entity*.

Chapter 8 Conclusions

In this final chapter the experiential origins of the thesis, formulated as questions about how learning from practice and the production of knowledge can be conceptualised, are reviewed. A conclusion of this thesis is that if complexity is understood as being based on complex living relations, as exemplified by John Dewey's trans-actions, it can function as an onto-epistemological framework for inquiry into living human processes. A further conclusion is that, conceptualised this way, complexity offers a means of thinking about generativity, specifically the generation of human meaning, and about how the indeterminacy that underlies all aspects of human life can be better accommodated epistemologically to provide more functional theory development. The final conclusions of this thesis are that such a complexity perspective allows human processes to be re-conceptualised in functional terms as being based in, and emergent from, co-present group function. Co-present group function includes the processing of shared affect, so that individual functionality is not wholly co-terminous with the physical body. This shared processing of affect allows meaning to be attributed to human experience. This then emerges, through the complex system of the individual, to be experienced subjectively as learning, and through the complexity-reducing inter-action between group participants (Luhmann's communicative process) as social communications, from which all social phenomena, such as bodies of knowledge, are ultimately derived.

1.2 ORIGINS OF THE THESIS

Although this thesis is the result of recent formal conceptual research, its origins lie much further back in aspects of my clinical work in the medical sub-discipline of psychiatry, and in a growing interest that I have had in continuing professional

development in medicine. In my work as a clinician I am continually confronted with differences between the profession's largely implicit but pervasive understanding of what constitutes practice, learning, the relation between the two, and my own experience. My experience of practice, my understanding of how I learn in relation to that practice, both learning 'for' practice and learning 'from' practice, and of how I use the formal body of knowledge that constitutes the psychiatric community's body of explicit knowledge, are very different from what is suggested by the collective profession's formal understanding of these issues.

That this experience is widely shared by my practitioner colleagues suggests that there is a significant gap between the espoused theories of professional practice and learning and the corresponding theories-in-use in the profession. It is this gap that provided the original impetus for trying to understand what is problematic about the espoused theories and how the more functionally useful theories-in-use can be formulated. This in turn led to the need to consider the relevant epistemological and ontological issues.

While I understand learning, knowing, know-how and the production of knowledge to be inseparable from practice in that they are mutually dependent, this thesis has evolved with a focus on the learning aspects of this whole.

Informal Experience

That there is a gap between what is formally presented as required medical knowledge and how knowledge is understood and used in practice can be illustrated in a number of ways. An informal illustration is the common response of anxiety in medical practitioners to plans for formal procedures such as forms of re-certification. As part of my professional work I belong to the professional body, 'the College', which is primarily responsible for the certification used as a basis for Australian Federal Government registration in the medical specialty of psychiatry. This certification currently depends on exit (from post-graduate training) examinations. Mandatory requirements of medical practitioners for review of work practice across a professional lifetime, through participation in continuing professional development, are only currently (2010) being introduced. Several years ago, before the College had instituted a

continuing professional development program, there were rumours among colleagues that it was going to introduce some form of recertification for those already practising. When my colleagues recounted these rumours they invariably added, in a panicky tone: 'But I wouldn't pass the exams again if I sat them now'.

These comments about not passing the current exit exams were probably true. Through the 1990s there were studies in the literature demonstrating that for practising medical specialists there is a dramatic fall-off over time, of the explicit knowledge that is required at exit exams (see for example Ramsey et al., 1991). This suggests that practitioners lose knowledge that they have had at the time of the exit exams and/or do not keep up to date with advances in professional knowledge. In medicine there is a widespread assumption that there is a direct correlation between the possession of a body of explicit knowledge, such as that that is needed for passing the exit exams, and the ability to practise safely and well.

However, the original situation is more complex as clearly neither my colleagues nor I believed that we were poorer practitioners because of an inability to pass the current exit exams. If asked, we would have said that the experience of practice since we had passed the exit exams had made us better practitioners than we had been on starting our professional practice. Again, these views would have probably been right. There is evidence to suggest that an experienced medical specialist's mode of working differs from that of a novice. So, for example, experienced specialists are faster and more accurate at making diagnoses than are either novice specialists or students (Patel et al., 2002), something that may be related to the use of previous experiences of practice as exemplars for future practice (Norman et al., 2007). There is now some acknowledgement within medicine that the current models used to guide policy and programs in the areas of learning in medicine, and maintaining practitioners' functional capacity, fit poorly with what happens in practice, otherwise the community would be 'overwhelmed with incompetent professionals' (Regehr and Mylopoulos, 2008).

The implication of our understanding of why we may not pass current exit exams but are not necessarily incompetent in our work, is that something has been learned from

the experience of practice that was not learned in pre-practice contexts. If so, what is it that has been learned through experience and how has it come about? How can this learning be conceptualised? How is it related to theory and to knowledge derived from research?

More Formal Experience

In a more formal way, this thesis has been stimulated by my personal involvement in the development of a form of continuing professional development in psychiatry that is based on work in small co-present groups (that is, groups where participants are known to each other as specific individuals). These groups, named 'Peer Review Groups', established by a small group of practitioner-researchers in 1991 (Balla et al., 1996; Beatson et al., 1996), were adopted into the College's bi-national (Australia and New Zealand) continuing professional development program when it was set up. The groups are self-selecting and self-directing groups of professional peers who meet regularly to review each others' work with the purpose of learning rather than for formal assessment. They largely manage their own functioning. Most critically, they are not required to follow external directions in relation to their content, nor are they required to make any external report on their discussions. They provide a significant and meaningful form of learning for participants as evidenced by their voluntary uptake in the College's program, despite the time-cost involved. Participants use these groups for a range of purposes, from the more simple purposes of acquiring information, to comparing their work with that of others to see how their thinking and practices 'fit' with those of colleagues, to the more complex and subtle purpose of sharing their anxieties and other affective experiences with the group through the presentation of work difficulties for the group to think through. This is a process which I will argue in later chapters is both fundamental to learning and the origin of the production of knowledge. This process, based in mutual trust between group members, takes time to develop. It is associated with a deepening in the quality of learning about practice, and it is learning that is often not realised until it emerges in later, new contexts (Balla et al., 1996; Lancaster, 2008).

Peer Review Groups, however, represent a still uncommon form of learning activity in continuing professional development programs in medicine. Unlike most other group activities in the College's continuing professional development program, where individual participants are encouraged to plan 'learning outcomes' and demonstrate what they have achieved, these groups function in the service of the group's evolving self-determined needs. The groups resist external direction and they do not produce the measurable 'product' of 'learned' or 'updated' information, a feature of most continuing professional development activities. While the College, as the 'parent' organisation of these groups, supports their existence, it has its own organisational needs, such as demonstration of its accountability to government agencies for its continuing professional development program and its broader accountability to the community for the functioning of its members. Meeting these requirements results in intrusions into the groups' functioning, often in ways that are detrimental to the groups, so their mode of functioning in the continuing professional development program requires on-going protection which is not always successful.

That these groups are popular as a learning activity raises the question of why this should be so. What do they provide that more traditional continuing professional development activities do not provide?; how can the learning that participants describe as occurring as a result of participation in these groups be conceptualised? and, how is it related to the formal knowledge that is traditionally understood as the basis of practice?

1.3 THE TRADITIONAL VIEW OF PRACTICE, LEARNING AND KNOWLEDGE

There is what can be described as a traditional model of what practice, learning and knowledge are, and how they are related. It is reflected in the assumptions made by my colleagues referred to above. It pervades the medical literature and in unexamined form it underpins continuing professional development programs in medicine. It is derived from long-standing community conceptualisations that are found across many practice disciplines.

In this model, practice, knowledge and learning are conceptualised in mechanistic terms. A practice, such as professional practice, is understood as a form of instrumental problem-solving activity by an individual whereby some previously learned abstract knowledge is 'applied' to a current, already defined, problem situation (Schön, 1983, 21-30). The knowledge needed for such practice is theoretical, understood as a representation of reality that has an existence of its own, independent of any 'knower' and any context of time, culture or social situation (Hager, 2007). It is derived from formal research processes and can be stored in data-bases, texts, guidelines, instruction manuals and human minds. It is unchanged by the process of being passed from one mind to another through instruction by a teacher. Learning in this model then is understood as the 'transfer' of this and other externally sourced knowledge into the practitioner's mind, as the term 'knowledge transfer' suggests, in order to be later 'applied' as practice (Hager, 2005). In turn, practice itself is understood as the 'application' of this previously learned knowledge to a practice situation, although what is meant by 'applying' is never elaborated.

While this is a simplistic description of the standard or traditional model of practice and learning, it is drawn to highlight the underlying 'bones' of the model. In medicine, continuing professional development is largely limited to what is called continuing medical education, based on this traditional formulation of the nature of practice and learning. So, in continuing medical education, learning is conceptualised as in the traditional model: the taking in, by an individual, of an explicitly formulated entity, 'knowledge', from an external provider. The focus of theorising is on how to improve this process of outside-in 'knowledge transfer' (Davis, 2006; Graham et al., 2006); on how to best access and manage medical information from external sources (see for example Manning, 2003; Moore and Pennington, 2003) and on how continuing medical education programs should support this process (Bennett et al., 2000). Thus further questions about the nature of practice and the issue of the links between experience of practice and learning remain largely unexplored.

There is an awareness in some areas of the field of continuing medical education of the limitations of such a formulation. Research since the mid-1990s has demonstrated that

traditional continuing medical education activities produce very limited new learning in practitioners, even less change in practice behaviours and have negligible effect on improving clinical outcomes (Davis et al., 1995; Davis et al., 1999; Mansouri, 2007). While in the literature there is evidence that learning from the experience of practice is significant (Holm, 1998; Stanton and Grant, 1999; Norman et al., 2007), acknowledgement of this is not widespread and for some authors the experience of actual practice is considered to be irrelevant to learning (see Regehr and Mylopoulos, 2008). This latter disavowal of the value of any learning that might emerge from the experience of practice has been fostered since the mid-1990s by the spread of what is known as Evidence-based Medicine, a body of theory, to be described in the following chapter, itself based on the traditional understanding of practice and learning as above.

1.4 INTRODUCTION TO CHAPTER 2 EVIDENCE-BASED MEDICINE

In the following chapter I will review the literature on Evidence-based Medicine in order to consider why it fails as a practice while it functions so powerfully as a rhetorical device and an administrative tool. How Evidence-based Medicine works and doesn't work can then be used to illustrate the conceptual limitations of the epistemological framework on which it is based and which characterises social inquiry more generally.

There is much material in the medical literature that makes reference to Evidence-based Medicine. However, this material is overwhelmingly made up of papers on the results of clinical research trials as prescribed by Evidence-based Medicine, and with prescriptions for their clinical 'application'. There is a dearth of material on Evidence-based Medicine as a construct. What little material there is, is largely written by critics of Evidence-based Medicine and addresses its limitations. These limitations are widely known experientially by practitioners in the clinical field, as illustrated by the evidence that practitioners do not use Evidence-based Medicine in its traditional format or in its current incarnation as the clinical practice guideline, but these limitations are rarely formally acknowledged. Critics of Evidence-based Medicine look at its failures in *practice* which allows them to delineate the unarticulated assumptions about the nature

of medical knowledge and medical practice that form its base. These assumptions are illustrated in the Evidence-based Medicine definition of 'evidence', a narrow definition which is arguably unjustifiable, and in Evidence-based Medicine as a proposed practice, based on an out-dated and reductive understanding of practice as a technology of 'applied theory'. As will become clear, this critical assessment is one-sided. There is a paucity of material written by proponents of Evidence-based Medicine as a construct. In this literature there is commonly a restating of Evidence-based Medicine's proposals with no attempt at justification. This appears to be because proponents accept these proposals as being self-evidently true and good.

While Evidence-based Medicine provides an example of a disturbing aspect of thinking in medicine, it has significance beyond medicine itself. The broader construct of 'evidence-based practice' is appearing in other areas of professional practice and similar basic problems for practitioners and practice can be expected to arise from it. Hence the problems brought by Evidence-based Medicine that I will elaborate on in the following chapter should be understood as exemplars of the sort of difficulties that will arise for practitioners where 'evidence-based practice' is implemented in other disciplines.

CHAPTER 2 - EVIDENCE-BASED MEDICINE

INTRODUCTION

Since its introduction in 1992 by a small group of Canadian epidemiologists, the term 'Evidence-based Medicine' known by the shorthand 'EBM', has become ubiquitous in the field of medicine. A broad description of Evidence-based Medicine is that it is 'the demand that clinical practice and, increasingly, all health policy and practice be based on systematically reviewed and critically appraised evidence of effectiveness' (Lambert, 2006). However, when the term was initially introduced in 1992, it only addressed individual clinical practice and it took form of a definition of acceptable evidence, the value of which was, and still is, hierarchically graded and a procedure for its implementation as a practice, as will be outlined below.

The theory of Evidence-based Medicine is consistent with the epistemological framework of traditional thinking about how knowledge, practice and learning are to be conceptualized in social science fields such as medicine. This means that there are some unquestioned premises about the nature of such concepts underlying Evidence-based Medicine. These relate to linked assumptions that knowledge is produced by formal research and can be fully and explicitly articulated and that learning is an accumulation of this knowledge in the practitioner's mind which has to be continually up-dated. Practice, then, is conceptualized as an 'application' of this explicit knowledge to the problem situation at hand (Beckett and Hager, 2002; Hager, 2002). Medical knowledge, when defined in this manner, can be packaged in explicit guidelines and the use of such guidelines in practice is considered to be feasible, appropriate and to lead to 'best practice' outcomes, although there is little research to support these claims as a general principle. 'Best practice' is a mantra believed to represent the implementation of Evidence-based Medicine as a practice. The term is used in the singular, implying that for any medical process there is one 'best' practice.

The intention of the epidemiologists who introduced Evidence-based Medicine was to improve patient outcomes in medicine. It has long been known that medical interventions can result in injury and death. One of the strictures of the Hippocratic

Oath, that of 'do no harm' to patients, refers to the possibility of harmful neglect or injury. Despite accumulating medical knowledge and continually improving technology, misdiagnosis may be as common as it was fifty years ago. Currently, just under a third of post-mortem examinations reveal significant diagnoses that were missed before death, and across hospital and community care about 10% of patients suffer some form of 'medical harm', some of it related to the increased use of technology (Schattner, 2003a; Schattner, 2006). The issues of how to improve the quality of medical care and how to reduce harm predate the advent of Evidence-based Medicine. They are and always will be areas that have an ongoing need to be addressed. However, what is problematic about Evidence-based Medicine is not its initial aim of improving medical practice, but the mechanisms by which this aim is to be reached and the effects they have on medical practice.

In this chapter, I will review Evidence-based Medicine with a focus on the problems that it introduces for practitioners and for medicine as a whole. Taking such an approach illustrates the way in which Evidence-based Medicine's ultimate failures are a result of the limitations of the epistemological framework within which it has been conceptualized. I will explore some of the concepts encompassed by the term Evidence-based Medicine and the uses to which they are put, by looking at the following aspects:

2.1 The origins of Evidence-based Medicine in the specific sub-disciplinary field of epidemiology (the study of populations in medicine) and at a specific geographic site and time, McMaster University, Canada; early 1990s.

2.2 Definitions and structure of Evidence-based Medicine.

2.3 Practical problems with Evidence-based Medicine related to the limited definition of 'evidence', and with it processing and production.

2.4 The limitations of critical debate about Evidence-based Medicine within the profession which provides part of the context in which it now flourishes as rhetoric while failing as a practice.

2.5 The significant areas where Evidence-based Medicine has failed on its own terms which are that Evidence-based Medicine is not itself evidence-based and that Evidence-based Medicine does not offer practitioners an alternative to reliance on expert opinion but attempts to substitute the expertise of biostatisticians for that of clinical expert and community of practice.

2.6 The epistemology that underlies Evidence-based Medicine, with its basis in a conceptual reductionism which accounts for its failure as a practice but also for its spread as a construct to organisational and managerial fields.

2.7 The current place of Evidence-based Medicine in clinical practice.

2.8 The current place of Evidence-based Medicine as a rhetorical device adopted by managerial interests

2.1 THE ORIGINS OF EVIDENCE-BASED MEDICINE

Evidence-based Medicine was developed in the 1980s and early 1990s. It grew out of concerns that a group of clinical epidemiologists at McMaster University, Canada had about the efficacy of medical interventions (Upshur, 2006). Clinical epidemiology is the branch of medicine concerned with population studies of disease and treatments. The 'patients' that clinical epidemiologists deal with are not the individual people that the clinician encounters. They are the abstract 'variables' and 'samples' of the experimental and statistical studies of epidemiology. Critics of Evidence-based Medicine argue that one of the failings of Evidence-based Medicine as a practice originates in the failure to understand that there is a distinction between the patient as 'variable' and as the encountered person of clinical practice (Mant, 1999).

The McMaster epidemiologists' development of Evidence-based Medicine arose from their view that medicine as it was practised (and how it largely still continues to be practised) was based on 'habit' and a reliance on ill-informed and authoritarian experts. They formed the view that medical treatment could be improved and that harmful or ineffective medical investigations and treatments could be reduced if practitioners limited their practice to that supported by findings from clinical research. Clinical

research is based on what is known as 'clinical science' which uses selected aspects of individual patients and human controls as the primary units of investigation. It can be differentiated from the 'basic sciences', such as physiology or biochemistry, which focus on 'smaller units such as the gene, the cell, or animal models' and with epidemiological research which looks at average effects across population groups (Charlton, 1999). Clinical research involves multiple observations of selected patients, under controlled conditions, the results of which are then processed numerically. Information derived from clinical research was already used as a tool in medical practice before the advent of Evidence-based Medicine. However, what Evidence-based Medicine introduced was the idea that this information constituted the medical knowledge on which medical practice should be based. This idea is not new. Similar ideas have had previous incarnations in medicine, going back to the 19th century, with similarly limited success (Vandenbroucke, 1996).

The central idea of Evidence-based Medicine is that information from clinical research, called 'evidence', rather than being a tool for use by the practitioner, to inform his or her clinical judgement, should be used to *direct* the practitioner's thinking and actions. Initially, the individual practitioner is to go to the literature for this 'evidence', evaluate it for him or herself and then 'apply' it in practice, so the 'evidence' determines how the clinical situation was to be managed. Evidence-based Medicine was presented in 1992 as a 'new paradigm for medicine' (The Evidence-Based Medicine Working Group, 1992). It was, and still is, expected by its proponents[3] to entail revolutionary changes in the medical practice of the individual practitioner to whom it is addressed.

One of the factors that supported the development of Evidence-based Medicine is the belief that medical variation, that is, the differences in diagnoses and treatments between individual practitioners, treatment centres or geographic areas, must represent error. This follows from the view that situations of medical practice can and should be treated as standardised, meaning that there is a right way to work as a practitioner and a right way to manage a specific clinical situation. The problem with this view is that

[3] I will refer to the epidemiologists and the academic and clinical authors who argue for the implementation of Evidence-based Medicine as a practice, as 'proponents' of Evidence-based Medicine in this thesis.

while variation does encompass what can be understood as error, not all variation can or should be defined as evidence of error (Long, 2001; Buetow, 2005). Each clinical situation is unique and variation cannot be eliminated (Gilbody and House, 1999). Clinical decision-making necessarily takes place under conditions of uncertainty (West and West, 2002). New conceptualisations of problems and innovations in medical management can only emerge out of situations where standard procedures have failed to facilitate a desired outcome. Thus, the uncertainty inherent in any medical system should be regarded as inevitable and recognized as an opportunity for development (Saltman, 2008).

Another factor that has supported the spread of Evidence-based Medicine is the view of the McMaster epidemiologists, shared by many in the profession, that medical practice, generally, declines in quality over the time of the practitioner's working life: 'The practice of evidence based medicine seems to be able to halt the *progressive deterioration in clinical performance that is otherwise routine* and which continuing medical education cannot stop' (Davidoff et al., 1995) (my italics). This echoes the concerns of other workers, such as, for example, Ramsey, who assumes that any lack of 'stored' information in the practitioner's mind has a direct association with poor quality performance (Ramsey, 1991). Putting aside the unsupported nature of Davidoff's claim, these concerns illustrate the underlying understanding of Evidence-based Medicine proponents of knowledge as a 'thing' or substance, fully transparent, stored like a collection of objects, in the mind (Hager, 2002). It follows then that medical practice is an 'application' of this knowledge, a model of practice called 'technical rationality' by Donald Schön, whereby practice is understood as a process of instrumental problem solving by the application of standardized techniques derived from an underlying body of theoretical science (Schön, 1983: 21-37). An aspect of this conceptualisation, illustrated in Evidence-based Medicine, is that the mechanism of 'applying' is never specified. The limitations of the epistemological framework within which Evidence-based Medicine is situated makes any understanding of what could be meant by 'application' impossible.

In order to use the history and vicissitudes of Evidence-based Medicine to illustrate the gap between traditionally espoused theories of practice and use of medical knowledge and the real world of practice and learning from experience, including the experience of using formal medical knowledge, I will first describe something of what Evidence-based Medicine is as a construct, by elaborating on the way in which it has been serially defined and on its instructions for implementation.

2.2 DEFINITIONS AND STRUCTURE OF EVIDENCE-BASED MEDICINE

As initially presented, (The Evidence-Based Medicine Working Group, 1992) Evidence-Based Medicine was not formally defined, but described in terms of mechanisms of practice: those traditionally used in medicine, regarded as sources of error and therefore to be avoided, and Evidence-Based Medicine, a hierarchy of evidence and instructions for its implementation.

In Evidence-based Medicine as it was originally presented, the clinical opinion of the individual practitioner was described as 'intuition' derived from 'unsystematic clinical experience'. Expert consensus opinion, by which medical practice has historically been informed, was described as 'authoritarian' and vulnerable to bias. Evidence-based Medicine proponents did not consider these forms of knowledge to be adequate bases for clinical decision-making because of their 'unreliability'. Further, the use of pathophysiology (the mechanisms of basic science underlying disease) was to be 'de-emphasized' because it is conceptual rather than experimentally derived knowledge. These forms of knowledge in practice were to be replaced and a 'stress on the examination of evidence from clinical research' was to become the basis for clinical decision-making' (The Evidence-Based Medicine Working Group 1992). The underlying assumption of this approach is that practice should be based on what has been proven to work by mechanisms free from bias. Opinions, formed from either individual experience or expert group opinions, about what works or what could work in specific situations, were seen as being of low value or as 'non-evidential', as were beliefs about what should work, based on anatomical, physiological and biochemical theory. It is possible to see the beginning of a problem with Evidence-based Medicine,

even at this initial point because what *has* worked belongs to the past (Biesta, 2007) and to suggest that only what has worked should be done would be to bring all development or evolution of knowledge and practice to a halt.

Hierarchy of Value in Evidence-based Medicine

The proponents of Evidence-based Medicine defined what medical information should be accepted as the 'evidence' on which practice should be based. This definition was then presented in a hierarchy of value. The purpose of the evidence hierarchy is to link the results of research with the strength of recommendations that can follow from them. Randomized controlled trials were selected by the proponents as having special value in producing reliable information. The randomized controlled trial is an experimental research tool for testing hypotheses and it is commonly used in medical research where the research subjects are humans. The trial involves the use of two randomly allocated subject groups, one that will receive the intervention being tested and one, the control group that will not. The assumption is that the complexity of individual human variation will be controlled for and therefore will not influence the research results. However, and this is the major limitation of randomized controlled trials, the significance of any non-quantifiable and therefore non-controllable clinical phenomena is hidden from view and thus ignored in such trials.

The Evidence-based Medicine hierarchy placed (1) large randomized controlled trials at its head, adding meta-analyses of these trials to this level at a later date. These are followed by (2) smaller randomized controlled trials, (3) well-conducted cohort studies; (4) well-conducted case-controlled studies; (5) poorly controlled or uncontrolled studies; (6) conflicting evidence with the weight supporting the recommendation; and, at the bottom of the hierarchy, (7) expert opinion (The Evidence-Based Medicine Working Group 1992). If research from randomized controlled trials is not available, the practitioner is expected to move down the hierarchy until available research results are found. This hierarchy is given devoid of context and there is no indication of how the various levels should be integrated with each other if in conflict (Cohen, 2004). Nor is there any indication of what the practitioner is expected to do where, as is more

common than not in clinical practice, there is no 'evidence' meeting the criteria of the clinical problem.

As Evidence-based Medicine was initially presented, information from the basic sciences (e.g. biochemistry, physiology or pharmacology) had no place in the hierarchy, despite the fact that this source provides the origins of many of the hypotheses that are to be tested by randomized controlled trials and confidence in trial results is linked to antecedent biological plausibility (Sehon and Stanley, 2003). Other sources treated as non-evidentiary were the individual experience of the practitioner, expressed as professional judgement, the patient's perspective and any understanding that may arise from the doctor-patient relationship (which is not mentioned in accounts of Evidence-based Medicine). Also dismissed was information gathered using other forms of research methodology such as case studies, qualitative and other naturalistic methods or experiential sources (Williams and Garner, 2002).

Serial Definitions of Evidence-based Medicine

The definition of Evidence-based Medicine has undergone serial transformations since its introduction (Upshur, 2006). In 1995 a definition of Evidence-based Medicine was given as: '....firstly, clinical decisions should be based on the best available scientific evidence; secondly, the clinical problem - rather than habits or protocols - should determine the type of evidence to be sought; thirdly, identifying the best evidence means using epidemiological and bio-statistical ways of thinking; fourthly, conclusions derived from identifying and critically appraising evidence are useful only if put into action in managing patients or making health care decisions; and finally, performance should be constantly evaluated' (Davidoff at. al., 1995).

There have followed further transformations in the range of definitions of Evidence-based Medicine since. These appear to be as a response to criticisms of Evidence-based Medicine as major limitations with its use have become obvious to clinicians (Buetow and Upshur, 2005). Thus, in what can be seen as a response to the criticism that in Evidence-based Medicine's evidence the 'patient' is a generic statistical entity rather than an individual person, Evidence-based Medicine has been redefined as 'the

conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. This practice means integrating individual experience with the best available external clinical evidence from systematic research' (Sackett et. al., 1996). The first sentence is a much quoted definition of Evidence-based Medicine, however it is usually given without the following sentence which encapsulates the problem for a clinician attempting to use Evidence-based Medicine. The first sentence appears to be an account of the practitioner's role in medical practice as being based on his or her professional judgement. Writers from other disciplines use this quote to support arguments for 'evidence-based' approaches in their own field, (for example in science education, see Millar et al, 2008). However, as the following explanatory sentence makes clear, the definition of 'best evidence' is not best evidence *in the practitioner's clinical judgement*, but the already defined 'best available clinical evidence from systematic research', that is, the evidence of the Evidence-based Medicine hierarchy. A necessary part of clinical judgement for a medical practitioner is the freedom to discover what evidence is and is not going to be relevant in a particular situation (Black, 1998). This is denied the practitioner who, to paraphrase Henry Ford, may use any evidence he or she wants to, so long as it is evidence from the Evidence-based Medicine hierarchy. Sackett's definition given above remains current (Centre for Evidence-based Medicine, Oxford, 2009).

Attempts have also been made to incorporate 'patient preferences' into the definition to make it: 'the integration of best research evidence with clinical expertise and patient values' (Haynes et. al, 2002). However, 'clinical expertise' here is not defined as the term is usually understood, as being based on clinical judgement; it is defined in terms of a capacity to use Evidence-based Medicine's clinical research (Charlton and Miles, 1998; see Guyatt et al., 2004). This conflates professional expertise with capacity to 'perform' Evidence-based Medicine. In further efforts at clarification, proponents both insist that *clinical research findings* should direct practice by 'forming the basis' of it (Haynes, 2002) and at the same time, that clinical *experience* has an overarching role as it 'integrates' components of practice (Haynes et al., 2002). How 'integration' is actually meant to happen or what it means if 'clinical expertise' determines that 'best

research evidence' is irrelevant is not considered. These confused efforts in tacking on additional directions result from proponents' definition of medical practice as an 'application' of theoretical knowledge and these moves illustrate the difficulties that arise from the proponents' epistemological stance.

The on-going reconfiguration of Evidence-based Medicine means that there are now varying definitions and evidence hierarchies that are increasingly complex. By 2004 Upshur and Tracey found seven complex and incommensurable hierarchies of evidence (Upshur and Tracy, 2004). Currently for example, the Oxford Centre for Evidence-based Medicine has five grades of evidence with sub-levels: 1 a, b, c, 2 a, b, c, 3 a, b, 4 and 5 (Centre for Evidence-based Medicine, Oxford, nd), raising the question of 'what animates the desire for such a hierarchy' (Upshur, 2006). However, despite complications, the central idea of a hierarchy persists, as does the view that randomized controlled trials, and the meta-analyses based on them, remain as 'the gold standard', superior to all non-experimental forms of evidence (see GRADE Working Group, 2004).

The multiplicity of definitions of Evidence-based Medicine weakens the proponents' claim that Evidence-based Medicine is 'a new paradigm'. Proponents' efforts to include 'patient preferences', the claim that clinical expertise should integrate other aspects of Evidence-based Medicine (Haynes, 2002), and statements such as 'evidence is never enough' (Guyatt, 2004), meaning that clinical opinion and patient preferences are part of good practice, diminish the overall importance of the clinical research evidence. However, the persistent problem with Evidence-based Medicine is that while medicine as it is practised involves the consideration of all information judged by the clinician/clinical team and patient to be relevant evidence (Upshur and Tracy, 2004; Buetow et al, 2006), Evidence-based Medicine continues to require a privileging of the results of clinical research in its original hierarchal form.

Directions for Practice of Evidence-based Medicine

Having defined *what* evidence was to be used in clinical practice, the McMaster epidemiologists then defined *how* it should be used. They presented a mechanism for practice involving five linear steps to be taken by the individual practitioner:

1. formulating answerable clinical questions;

2. searching for the best evidence;

3. critically appraising this evidence;

4. applying this evidence to patients; and

5. evaluating the effect of this application

(Evidence-Based Working Party, 1992; Dawes et al., 2005).

Step one requires the practitioner to 'formulate a clinical question' that can be answered. This is reminiscent of Schön's account of how practitioners work with a problem situation to create/discover what the problem could be (Schön, 1995: However, in Evidence-based Medicine nothing is said about how such a formulation happens and the 'clinical question' is one to be answered by the clinical literature, not by the clinician, in consultation with the patient. As a proposed account of practice, these 'steps' illustrate a subtle shifting of the practitioner's focus away from the patient and towards the academic literature. It starts at a point *after* the clinician has made decisions about what he or she is dealing with, that is, after a diagnosis, at least provisionally, has been made. This is at odds with actual practice where the clinician's questions emerge from the iterative exchanges between practitioner and patient which precede any formal diagnosis (Malterud, 2002).

The literature by Evidence-based Medicine proponents focuses almost exclusively on steps two and three, the search for and appraisal of, 'evidence'. The Evidence-based Medicine literature treats practice as a series of mechanistic moves by the practitioner, where the patient is seen 'as an object from which information is to be gleaned and then

inspected' (Upshur, 2006) and to whom treatment is then 'applied', reducing the doctor-patient relationship to one of 'extract and apply' (Upshur and Tracey, 2004). Because Evidence-based Medicine incorporates no functional understanding of 'real world' practice, most accounts of Evidence-based Medicine practice do no more than repeat the five simple steps (see for example Gray and Pinson, 2003). No comment is made on how searching for and appraising evidence may influence or be influenced by, the numerous confounding issues of actual practice and no suggestions about how 'evidence' is to be integrated into clinical practice are given (Tonelli, 2006). Step four, 'applying the evidence', may be covered in as little as one sentence (again, see Gray and Pinson, 2003). Even Step 5, 'evaluation', is understood as applying to the adequacy of the *practitioner's performance of the five steps* (Centre for Evidence-based Medicine (Toronto), nd). The 'evaluation' of a process, in a clinical context, would normally be understood as being related to the *outcome of the process* for the patient rather than being related to the performance of the doctor. This suggests that for these authors the quality of clinical care is reductively equated with the quality of the doctor's performance in handling research material. This focus on the research literature at the expense of other aspects of practice is further illustrated by 'Evidence-based Medicine journal clubs' where, rather than the literature being searched in order to make sense of and organize thinking about clinical experience, the skill at searching the literature has become the focus of the activity and an end in itself (Sinclair, 2004).

The Initial Development of Evidence-based Medicine

Since the introduction of Evidence-based Medicine, huge resources have gone into the gathering and evaluating of randomized controlled clinical trials and the production of meta-analyses from these. Meta-analysis is a statistical technique for combining the results of a number of randomized controlled trials to allow for the uncovering of small effects and to strengthen findings. Randomized controlled trials and meta-analyses are gathered and synthesized to produce what are called 'systematic reviews'. Examples of systematic reviews are those accessible from the Cochrane Collaboration (The Cochrane Collaboration, nd), and that are reproduced in various dedicated journals (such as *Evidence Based Medicine; American College of Physicians Journal Club*). Systematic

reviews are presented as 'best current evidence'. They are commonly used as the source of information for the production of clinical practice guidelines that are produced in increasing numbers and appear to be a new version of Evidence-based Medicine. Before looking at Evidence-based Medicine's current place in medicine I will look at the problems that came with its introduction, most of which remain in its current incarnations and many of which accompany the spread of the concept of 'evidence-based' to other fields.

2.3 PRACTICAL PROBLEMS WITH EVIDENCE-BASED MEDICINE

The problems with Evidence-based Medicine, as already indicated, arise in multiple areas. Some are the result of problems inherent in Evidence-based Medicine as a construct, some are problems introduced by the attempt to superimpose Evidence-based Medicine on current practices. They range from immediately practical matters to the philosophical grounding of Evidence-based Medicine itself. Many of the problems have significant ramifications that are unconsidered in the Evidence-based Medicine literature because of the narrow framework within which it is formulated.

In terms of the problems with Evidence-based Medicine I will consider:

1. the limitations of what is defined as 'evidence' using the randomized controlled trial;

2. the added limitations in the production of meta-analyses, systematic reviews and clinical practice guidelines, based on the randomized controlled trial, and

3. the publication, access and source-of-funding problems that accompany these activities, which have ethical implications in their contribution to the commodification and commercialisation of medicine.

Methodological Limitations in the Definition of the 'Evidence'

Most valued as 'evidence' in Evidence-based Medicine are the results of randomized controlled trials and the meta-analyses derived from them. Randomized controlled trials are used by clinical epidemiologists in their clinical research and the extent to which

they are valued as the best source of medical information in Evidence-based Medicine can be seen as a reference to Evidence-based Medicine's origins in clinical epidemiology. The justification by Evidence-based Medicine proponents for placing randomized controlled trials and meta-analyses at the head of the hierarchy, rests on the belief that if they are methodologically sound then, in comparison to other research methods, the resulting findings will be unbiased and unequivocal (Norman, 1999). But, there are problems with the claims made for randomized controlled trials and meta-analyses as providing unbiased 'evidence'. They both have biases that are largely unaddressed in the Evidence-based Medicine literature. Further problems arise from the unacknowledged additional layers of interpretation that are introduced during the production of systematic reviews and development of clinical practice guidelines. The pursuit of pure, unassailable medical 'facts', subsumed under the title of 'evidence', reduces meaning so the significance of the 'evidence' becomes increasingly abstract and generalised.

Limits of Randomized Controlled Trials, Meta-analyses and Systematic Reviews

Biases naturally pervade any scientific endeavour. There are biases in the choice of the subject matter to be researched and in the questions asked of the research (Holmberg et al., 1999; Sehon and Stanley, 2003). Choice is a human activity, not an unbiased calculation. Clinical researchers acknowledge that subjective criteria such as 'intuitive response, aesthetics and politics' are included with the more objective criteria of 'impact value, feasibility, justification and potential impact' in selection of the research question (Sutherland et al., 1993). But biases need to be acknowledged so that they can be worked with. Randomized controlled trials provide information that is essential to the practice of medicine. In pointing out the limitations of how Evidence-based Medicine proponents use them, I am not suggesting that they themselves cannot be a valuable source of information. It is the overvaluation of the decontextualised randomized controlled trial that is problematic.

(i) Randomized Controlled Trials

There are methodological biases built into randomized controlled trials in clinical medicine research *before* randomization occurs. There are biases in the inclusion and exclusion criteria for the trial subjects prior to randomization. Selection for inclusion is subject to influences that are related to a common range of factors: age, gender, level of health, mobility, treatment history, ethnicity and social class and biases arising from those aspects of the human subjects that cannot be controlled for, such as the subject's expectations (Black, 1996; Stone et al., 2004). For social reasons, those treated in the various 'private sector' medical settings are underrepresented. The elderly and the young (children and adolescents), women and ethnic minorities are similarly underrepresented in clinical research trials (Julian, 2004). Women of child-bearing age or pregnant women may be excluded from trials. Patients with co-morbidity (more than one non-causally related clinical condition) who actually constitute 80% of people with illness (Mezzich, 2008) are usually excluded. Both those who decline to participate and trial drop-outs may share characteristics, such as capacity for treatment compliance, that introduce bias that cannot be ascertained (Williams and Garner, 2002; Schattner, 2003).

There are numerous situations in clinical medicine where experimental research such as the randomized controlled trial cannot be used. These have been summarised as situations where randomized controlled trials are 'unnecessary, inappropriate, impossible or inadequate' (Black, 1995). Randomized controlled trials may be unnecessary where observational studies overwhelmingly demonstrate effectiveness. A commonly given example of this is the discovery of the role of citrus fruit in the diet, in treating and preventing scurvy. Randomized controlled trials may be inappropriate where their study size is too small to detect rare conditions or uncommon effects, or because outcomes may not appear during the life of the study, as randomized controlled trials commonly only run for only 3-6 months. There are situations where randomization is impossible, such as where subject beliefs, which cannot be controlled for, are significant to the research outcome, or where co-morbidity of medical conditions means multiple possible combinations of conditions and treatments such that randomized controlled trials for all circumstances is not feasible. There are additional

situations where experimental methods are impossible for ethical, political, commercial, legal, or resource issues (Black, 1995; S. Lewis, 2007).

Randomized controlled trials are usually used in assessing interventions which are relatively easily formulated and measured, and which focus on common, simple and short-term issues. Many of them do not test hypotheses but simply measure effect sizes, such as those which compare a drug with a placebo (Charlton, 1997). As a research technique, they are inadequate where the intervention being considered is complex, such as where the outcome of an activity may be influenced by factors in interactions between the practitioner, the patient, and the setting in which the research findings are used (Black, 1995). Using randomized controlled trials in the setting of practical medicine leads to biases in the selection of research subject. There are biases towards those interventions which are amenable to randomized controlled trials. So, for example in psychiatric research there is an overwhelming bias towards pharmacological treatments in comparison with non-pharmacological treatments, such as psychological treatments, for this reason (among others). Randomized controlled trials are also biased towards individual interventions by individual practitioners. It is much harder to address the multiple-component interventions, carried out by multidisciplinary teams or groups of practitioners that are a feature of much of medicine, in both in-patient and ambulatory care settings. Randomized controlled trials are unable to address issues that are best conceptualized in terms of systems functioning. These are areas characterised by multifactorial processes, or areas which do not rely on technology but on human behaviours. An example is that of the quality and safety aspects of medicine, where systematic reviews of randomized controlled trials can produce distorted outcomes (Leape, 2002; Berwick, 2008). Nor do they address the complex contextual issues of practice such as the organizational processes that shape individual practice (Lambert, 2006).

The emphasis in Evidence-based Medicine on randomized controlled trials means a bias towards the internal validity of studies. This is the efficacy of the intervention being investigated in the trial. External validity is related to generalizability and to the effectiveness of the intervention in routine clinical practice. The lack of consideration of

the significance of external validity commonly means that efficacy and effectiveness are conflated (Williams and Garner, 2002). This means that actual effectiveness in the clinical setting has to be judged by the practitioner (Persaud and Mamdani, 2006). Thus in the complex situation of clinical practice, while randomized controlled trials give a measure of the efficacy of an intervention, they often say little of its effectiveness in everyday use (Black, 1995). They have been described as 'the best way to assess whether an intervention works, but the worst way to assess who will benefit from it' (Mant, 1999).

Randomized controlled trials are used in Evidence-based Medicine because they purportedly offer unequivocally 'valid' results for use by the clinician. However, independent, similarly designed randomized controlled trials, addressing the same question commonly have differing outcomes. Conversely good quality cohort studies may produce the same information as randomized controlled trials, where both ask the same questions. So, randomized controlled trials do not produce unequivocal 'evidence' as claimed (Charlton, 1997; Miettinen, 1998; Ashcroft, 2003; Miles et al., 2007). This means that they do not stand ahead of other sources of information that are put lower on the hierarchy in Evidence-based Medicine. Their value as a method is also related to their research context. Quantitative observational studies (such as non-randomized trials, cohort studies and case control studies) are complementary forms of research that should be used with randomized controlled trials to maintain contextual integrity in research (Black, 1996; Charlton, 1997; Sehon and Stanley, 2003; Hunink, 2004; Persaud, 2006). The same argument is made for the consideration of naturalistic studies (Dixon-Woods et al., 2001; Lambert, 2002). The hierarchy excludes valuable sources of information. Qualitative studies, which can provide information for clinical practice, are either low on the hierarchy or excluded altogether (Upshur, 2001). So are case studies and anecdotal sources of information, such as those commonly reported in the correspondence section of journals. These are known to be particularly useful for capturing rare or late-appearing events related to medical interventions (Aronson and Hauben, 2006).

(ii) Meta-analyses

Meta-analyses of randomized controlled trials also have methodological problems. They incorporate the problems of the randomized controlled trials that go into their production, while having an additional layer of problems of their own. They are difficult to do well, requiring a combination of clinical and statistical expertise (Bailar, 1997). As with randomized controlled trials, the meaning of any form of systematic study such as meta-analyses derives from knowing the multi-levelled contexts of their production (Miettinen, 1998) and the assumption that large subject numbers will compensate for the necessarily reduced experimental control is false (Charlton, 1996). There are similar limitations with their use: differences between the constituent randomized controlled trials within a meta-analysis may not become clear until results are available from several different meta-analyses which effectively control for these differences; results from analyses of the same subject matter may be discordant; they may difficult to use, with interpretation of results requiring statistical understanding beyond the capacities of the practitioner using them (Hampton, 2002; Lam, 2005; Herrmann, 2007).

(iii) Systematic Reviews

Yet further layers of uncertainty are introduced in the relatively unexamined area of the production of systematic reviews. These are the reviews produced by academic bodies that synthesize the randomized controlled trial and meta-analysis findings covering specific clinical interventions and produce recommendations on the basis of these syntheses. Systematic studies address highly specific questions that are shaped by the interest of the reviewing body that produces them, rather than the clinicians expected to use them. What they are able to produce is limited by the narrow evidence-base of randomized controlled trials and meta-analyses from which they are developed. Systematic reviews produced by the Cochrane Review are done by 'reviewers' who may be self-selected for the work and may have expertise only in bio-statistical analysis rather than the clinical subject matter (Charlton and Miles, 1998; Miettinen, 1998). Further, the recommendations from the systematic reviews are not distillations of 'pure science'. They themselves are consensus views, grounded in the group opinion of the statistical assessors of the various research bodies that produce them (Norman, 2003).

In practice, systematic reviews are commonly difficult to access (Julian, 2004) and searches produce biased results. While search strategies for the 'best evidence' on a subject would be expected to turn up the same material, parallel searches, even when done by health science librarians, commonly result in little overlap of results (Norman,1999). Further, 'evidence' is continually evolving so reviews can never cover all research (Guyatt, 2004). Systematic reviews may be unwieldy to use: Cochrane reviews may be up to 30 pages long and may take a couple of hours to consider (Lipman, 2004; Laupacis and Straus, 2007).They are often incomplete (Julian, 2004) and they date rapidly. Fifty percent of systematic reviews are out of date within five and a half years (Shojana et al., 2007). In more than half of the Cochrane reviews that are completed, the evidence in support of the studied intervention is found to be limited or poor (Laupacis and Straus, 2007). This means that the review's findings on the research are inconclusive and are thus of limited use in clinical practice. Most Cochrane reviews conclude that 'more research is needed'. Overall, more than 90% of them conclude with some similar such recommendation, including reviews where the intervention under study was found to be harmful (El Dib, 2007).

Clinical Practice Guidelines

While proponents of Evidence-based Medicine continue to assume that it will work as a practice (see for example, Dawes et al., 2005), over the last decade a shift is evident in the general medical literature towards an acceptance that the implementation of Evidence-based Medicine as initially presented, is not feasible. In its place, there is now an expectation that clinical practice guidelines derived from clinical research will be used in clinical practice. In casual usage within medicine, the term 'Evidence-based Medicine' is now coming to mean the use in clinical practice of 'evidence' from the literature or of 'Evidence-based clinical practice guidelines'.

The existence of *practice* guidelines pre-dates Evidence-based Medicine (Weisz et al., 2007). They are particularly useful in team situations where the work of a number of individuals needs to be co-ordinated, or where complicated processes, for example, the medication regimes of oncology, could not be carried out without the use of protocols or

guidelines. In this situation guideline use is contextualised and inevitably involves local variation (Berg, 1997b).

However, since the introduction of Evidence-based Medicine, there has been a proliferation of *clinical practice* guidelines. These are often drawn up by specialist medical bodies and are designed to be used by specialists of the discipline and others, such as general practitioners who may have had no input into their production. The name reflects their basis in the 'clinical research evidence' of Evidence-based Medicine. Efforts are going into the development of structured methods for guidelines: guidelines for guideline production (The Appraisal of Guideline Research and Evaluation (AGREE) Collaboration, nd) and into promulgation of guidelines as 'translating best evidence into best practice around the globe' (Holmes, 2008). Their proliferation is part of a professional effort to 'transfer' the findings of clinical research into practice, 'closing the gap between evidence and practice via 'knowledge translation'' (Davis, 2006; Graham et al., 2006). This terminology of knowledge 'transfer' or 'translation' conveys the pervasive conceptualisation of knowledge as a substance or commodity that can be packaged and disseminated as 'knowledge parcels for grateful recipients' (Davies et al., 2008).

The value of clinical practice guidelines depends both on the way in which they are produced and how they are used (Long, 2001). They share many of the problems of formal Evidence-based Medicine. Like the 'steps' of Evidence-based Medicine, use of most clinical practice guidelines in a clinical context begins *after* a provisional or differential diagnosis has been made, a process based on clinical judgement, and to which they do not contribute. Because they are usually derived in part from randomized controlled trials, meta-analyses and systematic reviews, they have similar limitations. Their quality is related to that of the original clinical research used and the transparency of the various contexts of their production. While they are commonly presented as being based on an unbiased evaluation of the relevant 'scientific evidence', closer examination reveals that as well as the 'evidence', issues such as the 'usability' of the recommendations and their acceptability in relation to health policies and stakeholders

and views about the methodological processes of the guideline development itself all contribute to the final outcome (Moreira, 2005).

Clinical practice guideline production is labour-intensive so guidelines have limited coverage of clinical situations (Lipman, 2004). They date quickly, so have short life-spans (Minhas, 2007). They commonly neglect some areas of stakeholder involvement, such as the patient's perspective (Minhas, 2007; Penston, 2007). And they commonly do not address editorial independence, the conflicts of interest, financial or otherwise, of the guideline producers (Minhas, 2007; Holloway et al., 2008; Rose, 2008). Overall, use of these guidelines is variable. Commonly, awareness of their availability and compliance with them by the target populations is low and they often languish unused (Timmermans, 2005; Rosenman et al., 2008). They may be locally useful and used, but may then be criticized for parochialism and lack of standardization (see Guo et al., 2007).

Clinical practice guidelines usually represent what their producers regard as 'best practice'. They reflect a central tendency in a range of acceptable practice patterns so deviation from a guideline may still be legitimate practice and cannot be assumed to be evidence of error (Long, 2001). Unfortunately the reductionism inherent in clinical practice guidelines means that they commonly do not contain any indication of this. They can give the impression that a single answer 'best practice' response to a problem exists. This allows the differentiation between 'best practice' and acceptable practice to be conflated for policy, medico-legal or regulatory uses (Berg, 1997a; Hampton, 2003; Hurwitz, 2004; Genius and Genius, 2006; Moses and Feld, 2008).

Systemic Issues: Publication, Commercialisation and Source-of-Funding Biases

Clinical research, like all forms of research, suffers from publication biases: larger studies are more likely to be published in the professional literature than smaller ones, and when published are published faster than smaller ones. Those reporting greater effect size are more likely to be published than those reporting a smaller or no effect size, so-called 'negative studies' (Naylor, 1997; Norman, 1999).

These already present publication biases are complicated by the increasing influence on publication of commercial interests. Evidence-based Medicine is not directly causal here, but it does play a part. Its inherent reductionism influences research funding and then fosters the commodification and commercialisation of the results of research, making it vulnerable to the role of 'a protector of corporate agendas' (De Vries and Lemmens, 2006). Much clinical research in medicine, even where done by academic institutions, is funded by pharmaceutical or medical product manufacturing companies. The companies necessarily have a focus that is on their product alone as an investigative tool or therapeutic agent. Their research results are their commercial intellectual property. Such commercial companies are able to, and do, shape the design of studies and control the submission or withholding of research results for publication for commercial reasons. This means that research evidence reflecting negatively on a product, evidence, say, that new product has no advantages over products already available, may be withheld from the public domain. Favourable evidence may be published, with slight variation, multiple times over. This distorts the information available in the literature for use by practitioners or by the reviewers producing systematic reviews or clinical practice guidelines and has significant clinical consequences (Rennie, 1999; Angell, 2000; Hampton, 2002; Lexchin et al., 2003; De Vries and Lemmens, 2006; Herrmann, 2007; Angell, 2008; Rose, 2008; Turner et al., 2008; Ghaemi, 2009). There is currently (2010) debate about implementation of a register where all studies are listed at inception which will provide research providence and catch 'missing studies'.

There is a further issue in relation to publishing houses' own commercial interests. For example, publishers of medical journals also publish 'Evidence-based' textbooks, raising concerns about their journal editorial function. This is considered by some to be a factor in the limiting of debate on Evidence-based Medicine and is just beginning to be considered (Charlton and Miles, 1998; Lexchin and Light, 2006; MacDonald and Downie, 2006; Miles and Loughlin, 2006; Upshur et al., 2006; Shahar, 2007).

These multiple problematic aspects of Evidence-based Medicine persist, even in its current incarnation as the Evidence-based clinical practice guideline, in part because of

limitations of any debate about the nature of Evidence-based Medicine, its costs and benefits.

2.4 LIMITATIONS OF DEBATE ABOUT EVIDENCE-BASED MEDICINE

There is an enormous body of medical literature with the phrase 'Evidence-based Medicine' in the publication title. Much of this relates to the production and use of 'evidence', as defined in Evidence-based Medicine, in specific areas of clinical medicine. There is very little material that relates to discussion of Evidence-based Medicine as a construct in clinical medicine. This absence of debate is related to the nature of Evidence-based Medicine as a 'movement', probably supported by its value as a managerial and regulatory tool of health bureaucracies, but this absence of debate also contributes to Evidence-based Medicine's failures.

What material there is, in the literature addressing Evidence-based Medicine as a construct, reflects relatively polarized views. On the one hand there is a group of proponents, which include the epidemiologists (Sackett, Guyatt, Haynes and others) who introduced Evidence-based Medicine. They remain arbiters of its definitions and are influential spokespersons for it. There is also a small, diverse group of critics, who focus on different aspects of Evidence-based Medicine, primarily those to do with its methodologies and its underlying philosophical and ethical failings.

Published debate about Evidence-based Medicine has been relatively impoverished. This poverty is related to what a number of critics have pointed out as the relative lack of direct responsiveness to criticisms by Evidence-based Medicine proponents and their lack of engagement in debate about it (Charlton and Miles, 1998; Buetow, 2002; Miles and Loughlin, 2006b). Much, in relation to views proponents hold about the purposes and functioning of medical practice, has to be gleaned from the assumptions that underpin their writing and from their use of language.

A number of factors arise out of this lack of debate. Firstly, to be discussed below, Evidence-based Medicine is itself not evidence-based and the pointing out of this situation by critics has not resulted in any evidence of reflection by proponents on their

claims for Evidence-based Medicine. Proponents rarely address criticisms in their published work and do not cite critics' work in their own (Buetow and Upshur, 2005; Miles et al., 2006b). Both of these activities are a traditional part of academic discourse and here can be seen as a missing essential aspect in the social construction of Evidence-based Medicine. Where specific criticisms are addressed, response from proponents is minimal (Hallenbeck, 2008) or criticisms are dismissed, commonly by being met with an unelaborated declaration. For example, what is presumably a response to criticism of Evidence-based Medicine's reductive injunctions, comes as a statement: 'Evidence-based Medicine is not cook book medicine' (Centre For Evidence-based Medicine (Oxford), nd), that is not elaborated on in any way. Alternatively, Evidence-based Medicine proponents argue that critics have 'misperceptions' of what Evidence-based Medicine is (see, for example, Straus and McAlister, 2000). It is a common institutional response to criticism to re-frame criticism as 'misunderstanding' (Charlton and Miles, 1998). This is usually followed by an offer 'to explain' by repeating or adapting what has been criticised. With Evidence-based Medicine, such adapting has resulted in the ever-changing and multiplying definitions of Evidence-based Medicine as described above. This is called 'evolution of Evidence-based Medicine' by proponents (see Haynes et al., 2002; Guyatt et. al., 2004) but it is presented without any account of what has contributed to the 'evolution' say, criticism from another source or problems encountered with some aspect of Evidence-based Medicine. Papers on the failure of uptake or implementation of Evidence-based Medicine or derived clinical practice guidelines often have 'Overcoming barriers to …', in the title and appear to be a published form of this institutional response (see Julian, 2004; Richardson, 2007). Implied in this phrasing is the unexamined assumption that the practitioner is failing to do something that self-evidently could and should be done. Such management of criticism been has described as 'management by incorporation' (Lambert, 2006) and it has the effect of hindering substantive debate about Evidence-based Medicine (Sehon and Stanley, 2003). This failure of adequate debate leaves the impression of Evidence-based Medicine as being a context-free phenomenon, internally propelled by adherents on the basis of their faith in it.

The failure by Evidence-based Medicine proponents to think about the consequences of what they propose reflects Evidence-based Medicine's origins as an approach to practice that was 'operationalized before it was conceptualised' (Miles et al., 2007), as illustrated by its initial lack of a definition. It moved 'from bright idea to implementation without critique, evaluation and testing' (Charlton and Miles, 1998). The critique has not happened within medicine and, at least in terms of Evidence-based Medicine as an espoused theory, its failings have been allowed to stand. The problem with this situation is that these failings are not harmless. I will look firstly at two significant areas where Evidence-based Medicine fails on its own terms, both of which stem from its unarticulated positivist underpinnings. The first of these is that it does not meet its own requirements as a practice to be 'evidence-based' and thus cannot be claimed to be effective, safe and cost efficient and therefore, in my opinion, ethical. The second area, which is related to medical practice, follows from one of Evidence-based Medicine's original rationales, that of freeing practitioners from any reliance on expert opinion. In Evidence-based Medicine this does not happen and the nature of the new 'expert' is a murky one.

2.5 FAILINGS OF EVIDENCE-BASED MEDICINE ON ITS OWN TERMS

Evidence-based Medicine is not Evidence-based

A number of authors (Norman, 1999; Norman, 2003; Upshur and Tracy, 2004) have commented on the irony that Evidence-based Medicine is not itself evidence-based. At its inception it was claimed that it would not be possible to show that Evidence-based Medicine was effective because no long-term randomized trials on it were likely to be carried out (The Evidence-Based Medicine Working Group, 1992). This is what has happened. No such trials have been conducted, but neither have any attempts to demonstrate effectiveness been made by any other means. Proponents acknowledge what critics point out, that there is no convincing evidence that shows that the assumptions underlying Evidence-based Medicine lead to superior clinical care (see Haynes, 2002). What is of concern is that this lack of 'evidence' is dismissed as insignificant. Thus it is argued 'By questioning the evidence for evidence-based

medicine are we asking the right question? Providing evidence from clinical research is a necessary but not a sufficient condition for the provision of optimal care' (Straus, 2002). This presumably means that evidence of effectiveness is only required of sufficient conditions.

Proponents of Evidence-based Medicine both claim that it can and should be practised while admitting that (in its five-step form) it cannot be. The claim that it can be practised cannot be said to have been argued, because no justification is presented for it. It is present as an underlying theme in the writing of proponents. This theme is both that Evidence-based Medicine can be practised and that the value and rightness of practising it is self-evident and requires no justification (Charlton and Miles, 1998).At the same time, in the editorial section of the *British Medical Journal* 2004 theme issue on 'What's the evidence that Evidence-based Medicine changes anything?' a number of proponents acknowledged what critics have pointed out, that it 'is nearly impossible to practise [Evidence-based Medicine] in everyday clinical care' and that its 'most basic assumptions are unproved, indeed largely untested' (Reilly; 2004) and that there is a lack of evidence that teaching Evidence-based Medicine translates into changes in clinical outcomes (Straus and Jones 2004), that is, that it is effective. However these comments do not lead to the addressing of the shortcomings but to platitudes about 'challenges' to be met and calls to arms such as: 'EBM is here to stay' (Del Mar et al., 2004); 'anyone who does not believe in it [EBM] is in the wrong business' and 'we must stand up for what we know' (Reilly, 2004); Evidence-based Medicine is 'unquestionably the right approach to follow in medicine, wherever and whenever possible' and 'the only way to view medicine' (Jenicek, 2006). All of which gives it the quality of 'a creed' that it has (Upshur, 2005).

The argument of Evidence-based Medicine proponents has been that the appropriate randomized controlled trials cannot be done to demonstrate its status in relation to effectiveness. There is opinion that this claim is groundless (Norman, 2003) and that it is not a valid defence while alternative research methods are ignored (Cohen, 2004). Currently, there is little if any research, using Evidence-based Medicine's own or other criteria to demonstrate that it has clinical benefits (Higgitt and Fonagy, 2002).

Evidence-based Medicine's claims in relation to its effectiveness and safety remain unsubstantiated thus it can only be considered as an experimental practice with all that that entails ethically (Buetow at al., 2006). In addition to effectiveness and safety, the lack of evidence of the effectiveness of Evidence-based Medicine is significant in relation to its cost. Enormous health care resources have gone into supporting Evidence-based Medicine; processing material for systematic reviews and the recommendations and guidelines that follow from them, and teaching and attempting to implement Evidence-based Medicine, all with no evidence of its effectiveness. These financial and time resources have to be diverted from elsewhere in health budgets (Cohen, 2004) and the costs of the distortions of health care produced by administrative funding on the basis of 'evidence' manoeuvres (Tanenbaum, 2005) will unfold over time.

Proponents' dismissal of the need for supportive evidence for Evidence-based Medicine raises the issue of where the burden of proof should lie. Gaskin's axiom of burden of proof is 'that the obligation to provide justifications or proof for a claim rests with its claimant'. This is because there is an asymmetry in standard of proof between that owed by the claimant, whose claim rests on the *realization* of the claim, and that owed by any critic, whose criticism relates to *potentiality* and only needs to be plausible (Kirk-Smith and Stretch, 2003). Failure to accept any obligation for justification of their claims means that proponents feel entitled to make comments such as the suggestion that where there is uncertainty about the applicability of research results, clinicians must ask 'Is our patient really so different from patients included in the trials that we can't apply the results?' (Laupacis and Straus, 2007). The implication is that individual patient presentations should be tailored to fit with the results of clinical research. Most clinicians would consider that research findings are to be used in the service of patients' needs, not the other way around. However, Laupacis and Straus' view is consistent with an Evidence-based Medicine understanding of clinical practice, where the practitioner's focus is in formulating questions to ask of data-bases and clinical expertise has been re-defined as expertise in implementing Evidence-based Medicine.

Whose Evidence? The Issue of Authority

The second significant area where Evidence-based Medicine fails on its own terms is described as 'the issue of authority'. This is related to how currently accepted thinking about clinical matters is determined. One of the tenets of Evidence-based Medicine was that it would free the practitioner from 'unreliable' experts, or empower 'clinicians so that they can develop independent views regarding medical claims and controversies' (Guyatt et. al., 2004). The clinical practitioner would do this by searching out the 'best evidence' from the literature and data bases (such as the Cochrane Collaboration) to use in practice. The intention to replace the role of clinical expert with a more abstract, supposedly 'scientific' and therefore reliable, form of authority called 'evidence' reflects a devaluing of clinical expertise, including group or consensus expertise, including what has been learned from experience. It reflects an understanding of clinical practice as an instrumental activity by an isolated individual, overlooking the collegiate nature of practice and the existence of a 'professional community of practice' for whom the medical expert, attacked by proponents as 'authoritarian' and 'unreliable' could be seen to function as a spokesperson for a consensus of current professional community opinion.

However it has become clear that it is not only the exponentially increasing volume of material to be searched and practitioners' time constraints, but also the limited usefulness of the process of data-base searches for individual consultations that means that practitioners do not do such searching (Tomlin et al., 1999; Gabbay and le May 2004; Upshur, 2005). This led to a shift in Evidence-based Medicine proponents' thinking away from the expectation that individual practitioners will evaluate the clinical research evidence themselves to the expectation that they will be 'users of research rather than producers of it' by relying on research bodies to provide pre-digested search results in the form of systematic studies, published abstracts and secondary journals with selected 'high-quality' studies (Del Mar, 2004; Guyatt, 2004). This means that practitioners will use the systematic studies derived from the original research and clinical practice guidelines based on these systemic studies (Guyatt, 2000). So, Evidence-based Medicine proponents expect to replace the clinicians' reliance on

clinical expert consensus with the unexamined substitution of an alternative form of expert consensus, that of the researchers involved in the production of systematic reviews and the clinical practice guidelines derived from them (Norman, 2003). Thus the 'evidence' derived from Evidence-based Medicine is not free from the bias of expert opinion; it is permeated by it (Hampton, 2002; Genius and Genius, 2006). It is just that the source of expert opinion has shifted from clinicians to the bio-statisticians producing systematic reviews and to guideline developers. The situation in relation to guideline development is more complex than that of systematic reviewer. Unlike the systematic reviews, clinical practice guidelines are commonly drawn up by groups who are practitioners themselves and who may draw up guidelines that reflect a tempering of clinical research findings and systematic reviews by their clinical expertise. These groups are commonly composed of the very experts that Evidence-based Medicine was designed to 'free' clinicians from.

2.6 EPISTEMOLOGY AND EVIDENCE-BASED MEDICINE

The limitations of Evidence-based Medicine and many of the problems it introduces can be understood as arising from unarticulated assumptions about practice, knowledge and learning. The primary aim of Evidence-based Medicine is to foster the use by clinicians of a particular, reductive form of medical knowledge in the belief that this will lead to an improvement of patient care. This, by Evidence-based Medicine's own standards would be an improvement that would be measured across populations. In contrast, clinical practice is ultimately based on the clinical encounter between a health system, as represented by an individual practitioner or small team of practitioners, and an individual, specific person, the patient. The focus of clinical research in medicine is the *efficacy* of a medical intervention across a population; however the focus of the clinical encounter is the *effectiveness* of management of a specific situation for a specific patient. These two different foci can never be reduced to the one (Tonelli, 1998; Tonelli, 1999; Mant, 1999).

The physician Mark Tonelli, in writing about Evidence-based Medicine, points out the philosophical gap that Evidence-based Medicine, with its reductionist perspective,

either overlooks or attempts to close. He argues that Evidence-based Medicine has two different meanings. One is as a form of medical epistemology. This is related to the Evidence-based Medicine definitions of what counts as medical knowledge, with that derived from clinical research weighted above all other forms and assigned the role of guiding clinical practice. The other meaning of Evidence-based Medicine is as a description of a form of clinical practice, based on the medical knowledge as defined (Tonelli, 1998). Evidence-based Medicine proponents understand practice formulated this way as closing the gap between the clinical research findings and clinical practice; hence the focus on getting research findings into practice, called 'knowledge transfer', that is a feature of the Evidence-based Medicine literature. However, Tonelli argues, this gap cannot be closed as it is 'an intrinsic, philosophical gap' which is inherent in the situation because the goals of public health, which is the domain of clinical epidemiology, relate to improving health across a population, whereas the goals of clinical medicine are to do with the health of an individual. The methods of clinical epidemiology involve minimizing individual variation, which is done using statistically based methods where variations that can be quantified are controlled for. In randomized controlled trials, this is done by the process of randomization. However results for the individual in a statistically-based research population cannot determine what is appropriate in a specific situation (Tonelli, 1998). Science moves from specific observations to general rules and clinical medicine has to interpret these rules in the specific context of an individual patient (Cohen, 2004). Where clinical research discovers variations that are not quantifiable, for the purposes of the research they are ignored, however this does not mean that they are irrelevant to research and in the clinical situation they may be critical. It is the existence of such variations which form an epistemological gap between research and practice. To ignore such differences is to devalue individuals, thus the existence of this gap has an ethical significance (Tonelli, 1998).

2.7 THE PLACE OF EVIDENCE-BASED MEDICINE AS A PRACTICE

Evidence-based Medicine currently appears to function primarily as an espoused theory and as a rhetorical device. Research on medical practitioner behaviour demonstrates that

there is a gap between reporting a positive attitude towards Evidence-based Medicine and its actual practice. There is evidence that suggests that Evidence-based Medicine as a practice has a very poor uptake, either by individual practitioners or working teams (Tilburt et al., 2006; Amin et al., 2007). Practitioners do not appraise the literature as directed, nor do they follow the 'five steps' outlined (Gabbay and le May 2004) and further, '95% of surveyed GPs are not interested in learning the skills of Evidence-based Medicine' (Centre for Evidence-based Medicine (Toronto), nd). There appears to be some, but very limited, uptake of clinical practice guidelines by practitioners (Lipman, 2004; Rosenman et al., 2008, Malhi et al., 2008) for a complex of reasons. In primary care it is thought to be related to the exclusion of primary care practitioners from the guideline development process (Rashidian et al., 2008). For practitioners, learning from one's own experience of the work (Hay et al., 2008; Whelan, 2009) and use of the community of practice knowledge that is shared with other practitioners, including those recognized as experts, continues to be central to practice (Gabbay and le May, 2004; Hay et al., 2008). However Evidence-based Medicine's rhetorical place in medicine is so powerful that its failure in practice is difficult to publicly acknowledge. The term 'the best evidence', as described, has been appropriated by Evidence-based Medicine proponents and defined as that produced by randomised controlled trials. As a number of authors have pointed out, the problem for practitioners is: who wants to be seen as being opposed to 'using the best evidence' (Tomlin et al., 1999; Sehon and Stanley, 2003; Tanenbaum, 2003)?

Work that looks at practitioner experience of Evidence-based Medicine suggests that the reason for its failure as a practice is that the use of information, such as clinical research findings, in a linear process, such as that outlined for Evidence-based Medicine or inherent in clinical practice guidelines, does not fit with how medical work is done in practice with individual patients. There is a gap between the concept of biomedical disease, which Evidence-based Medicine addresses, and the individual patient's presentation of illness which may or may not involve disease (Freeman and Sweeney, 2001; Lipman, 2004; Schattner, 2006). Medical practice is profoundly contingent in nature (Pope, 2003), much of the knowledge used is tacit (Thornton, 2006; Henry,

2007), and for the practitioner, the need to maintain the doctor-patient relationship and to tailor clinical management to accommodate patients' wishes, because these are what will direct the patient's actions, is more significant than implementing abstract research findings (Tomlin, 1999; Freeman and Sweeney, 2001; Naylor, 2001; Pope, 2003; Tracey et al., 2003; Gabbay and le May, 2004; Upshur, 2005).

Evidence-based Medicine begins after an already formed, albeit tentative, diagnosis in the form of a 'question' for the literature, ready to direct further investigation or treatment, has been made. It does not address how such a question is formulated. (This difficulty is related to the lack of acknowledgement, in the reductive Newtonian framework, of complex relations, from which hypotheses emerge, a point to be elaborated on in the following chapter.) In practice, the practitioner's involvement in the clinical encounter begins long before any point of diagnosis. As with other human disciplines, the clinical encounter is a direct human interaction, described as a dialogue (Gadamer, 1996: 125-140). It is within this dialogue that the formulation of hypotheses, choosing strategies to pursue, and seeking evidence of all kinds, occurs (Malterud, 2002). The clinical encounter is a multilayered, complex, iterative process involving practitioner and patient in a negotiation of what the patient's presentation *means* and what will constitute an acceptable outcome for both parties.

While clinical research pre-dates the advent of Evidence-based Medicine and would continue without it, Evidence-based Medicine has, despite its limitations, reminded individual clinicians that a specific kind of research finding has a place in clinical medicine (Porta, 2004; Genius and Genius, 2006). Critics of Evidence-based Medicine as a practice still see the research material as having value when it is conceptualised as a tool, for use in practice, with the knowledge of its limitations (Naylor, 1995; Tonelli, 1998). The investment in systematic reviews makes this kind of research increasingly accessible to practitioners. I am aware that the exponential increase in medical information means that there are significant problems related to how it is to be processed such that useful information can be accessed by medical practitioners and that significant new information can be circulated. My criticism of Evidence-based Medicine is limited to its proponents' solutions to these problems.

It is known that individual practitioners do not spend significant time doing literature searches of original research themselves, but that they prefer digests or local expert opinion which they believe to be based on the 'evidence' (Lipman, 2004). Non-application of 'evidence' does not necessarily reflect ignorance of research findings. There is evidence that clinicians do look up systematic reviews and guidelines suggesting that even though they may commonly not follow guideline directions, the 'evidence' is thought about in practice. 'Evidence' is used, or not used, for reasons that are considered to be *clinically* justifiable in tailoring management for individual patients (Freeman and Sweeney, 2001; Gabbay and LeMay, 2004). This is consistent with the manner of use of 'decision-support techniques', those information tools such as guidelines, protocols, clinical decision analyses outlined by sociologist Marc Berg, who describes the way in which these tools, while intended to 'be applied' to prevent variation from a statistical norm, are invariably adapted for local use (Berg, 1997b). The Evidence-based Medicine derived 'evidence' or guideline is only one factor among many that contributes to the complexity from which decisions will emerge in any medical process.

Medical practice in Evidence-based Medicine can be presented as fully determined and formalised because its basic reliance on the randomized controlled trial leads to bias in medical processes towards what can be quantified, a bias that is evident in the medical literature, funding of research and teaching of students. Because of its privileging of quantifiable evidence Evidence-based Medicine does not 'logically differentiate human beings from machines' (Henry et al., 2007). This means that aspects of the clinical encounter, particularly those in primary care (general practice), that involve subjective experience such as suffering and pain; psychological aspects such as the meaning for the patient of his or her situation; and the doctor-patient relationship, do not appear in Evidence-based Medicine literature. Where issues related to chronic illness, disability, quality of life or dying are determining factors in management, such as is common in older-age medicine or palliative care, Evidence-based Medicine is silent, although death itself is referred to (death can be quantified) (Hallenbeck, 2008). Similarly, areas of psychological medicine where the therapeutic relationship is the tool of treatment, are

unaddressed by Evidence-based Medicine (Williams and Garner, 2002; Maier, 2006). Also, more generally, the 'know-how' of medical practice, such as the physical skills and dexterity which are a central aspect of procedural practices in medicine such as surgery (Pope, 2003), or the tacit knowledge that, say, informs the haematologist's recognition of what is abnormal enough to interpret as pathological in a blood slide (Atkinson, 1995: 60-89), is ignored. This 'know-how' of practice is a process that is not a linear calculation but has to be 'defined and adjudicated' (Atkinson, 1995: 2) using professional judgement.

Clinicians have broader concerns about the impact of Evidence-based Medicine than its impact on their immediate practice. As a clinical practice, Evidence-based Medicine in its varying forms may not be widely or consistently used, however it has come to have a significant influence on practice from an organisational level. Students are being taught Evidence-based Medicine as if it can be practised and they are taught to value the randomized controlled trial and to mistrust clinical judgement and local community of practice consensus. How this will shape their functioning as practitioners will unfold over time. There are concerns that use of Evidence-based Medicine in medical schools is producing a generation of medical technocrats who have been taught how to research data-bases but not how to listen to and talk with patients (Borenstein, 2008) and that requiring medical trainees to put aside their own professional judgement in favour of following guidelines impairs the development of critical thinking necessary for the development of clinical judgement (Broom, et al., 2009).

2.8 'EVIDENCE-BASED' EVERYTHING

Evidence-based Medicine has a powerful rhetorical presence within medicine. This appears in its use as terminology in the academic literature where it is used to cast a veil of legitimacy over whatever it is attached to. It exercises further significant influence through its spread from its original place in clinical medical practice to the broader health care field (Upsher et al., 2001). Here the uptake of the concept of 'evidence-based practice' by health administration bodies has become part of organizational functioning in medicine, most detrimentally when used to promote 'no evidence, no

funding' policies (Tanenbaum, 2003). By focussing only on quantifiable aspects of practice Evidence-based Medicine paves the way for control of practice by organizational, managerial (Berg, 1997; Tanenbaum 2005; Genius and Genius, 2006) or legal (Hurwitz, 2004; Moses, 2008) interests. Professional protest about this issue is not one of protection of medical 'power' as is commonly argued in the sociological literature (Lancaster, 1997; Pope, 2003). Practice based on professional judgement is what underpins a practitioner's capacity to act in the best interests of an individual, specific patient. What those interests are is determined within the context of the fiduciary doctor-patient relationship and cannot be prescribed from an external vantage point or calculated from guidelines, which necessarily address the generic situation. Guidelines drawn from research findings cannot be a substitute for ethical practice. They are limited to being a more or less useful tool for the practitioner in *the process of* ethical practice.

Evidence-based Medicine has been operationalized to become 'Evidence-based Practice' (Dawes et al., 2005) which has now become a construct in its own right, the use of which spreads beyond medicine. It appears, for example, in fields such as nursing, psychology (Peterson, 2004), mental health (Tanenbaum, 2003) and disability services (Burton and Chapman, 2004). In these fields it produces a similar range of responses from practitioners as it does in the field of medicine. 'Evidence-based Practice' appears in the organizational areas of management and policy development in health systems (Cooper, 2003; Tanenbaum, 2005; Dobrow et al., 2006; Genius and Genius, 2006) and the public health areas of health promotion and health policy (Petticrew and Roberts, 2003; Kemm, 2006; Davies et al., 2008). However, use of the term 'evidence-based' here, as with Evidence-based Medicine, rarely applies to organizational functioning itself. It refers to the nature of the medical, health or other, knowledge and forms of practice acceptable to the organization. The term 'Evidence-based Practice' used by a health organisation, commonly means funding only for 'Evidence-based' interventions by others (health practitioners) rather than by the organisation itself.

The reductionism that pervades Evidence-based Medicine in its clinical context was initially presented as an effort to make practice 'scientific'. However, the rapid and wide-spread uptake of 'Evidence-based' rhetoric and requirements that practice be 'evidence-based' by managerial and organizational aspects of medicine can be understood as having a different basis in bureaucratic functioning. In a bureaucracy reduction can be used as a method to give the appearance of legitimacy, certainty, and control to processes (Porter, 2003). This makes Evidence-based Medicine appealing to organisational management, as it provides (in theory) already quantified material on clinical interventions and outcomes for organisational processing. This matches the needs of health bureaucrats who have to plan, cost and guarantee delivery of services, commonly from a distance and for larger-than-local areas. It can be argued that it is the matching of the reductionism in Evidence-based Medicine with managerial needs that has fostered the organizational requirements for 'Evidence-based Practice' in medicine and its spread to other fields.

'Evidence-based' now appears in fields other medicine, such as education (Simons, 2003; Schwandt, 2005; Biesta, 2007) including medical education (Leung and Johnston, 2004; Dornan et al., 2008), social welfare, and the field of crime and justice (the Campbell Collaboration, nd). The spread of Evidence-based Medicine concepts and terminology to other fields, 'like a virus' (Loughlin, 2006), has been with a strength and rapidity not associated with other medical constructs because Evidence-based practice serves a purpose across a broader range of social contexts. The sociologist Marc Berg describes the way in which defining clinical judgement as statistically deficient then allows protocols to be 'invented' to correct the 'problem' (Berg, 1997(b): 80-102). In a similar way 'Evidence-based' has become 'a public idea', that is, an idea that both describes and defines a public problem *and* offers solutions to it (Tanenbaum, 2003). This suggests that there are significant issues in a broader social context than I am considering here that contribute to Evidence-based Medicine's progress as a social phenomenon.

2.9 CONCLUSIONS

The primary purpose of Evidence-based Medicine when it was introduced was to re-shape medical practice in a way that would improve practice and lead to both better outcomes for patients and a reduction in ineffective or harmful medical interventions. While Evidence-based Medicine proper has failed as a practice, its basic premises about the nature of medical knowledge and how practice is constituted live on in the form of professional assumptions about the 'medical evidence' of systematic reviews and clinical practice guidelines. These assumptions are shaped by the limits of the positivist framework which underpins Evidence-based Medicine as a medical epistemology and as a clinical practice (Tonelli, 1998; Miles et al., 2007).

Evidence-based Medicine and Reductionism

Evidence-based Medicine is a 'prescriptive phenomenon' (Tonelli, 1998). It is composed of a series of statements and injunctions originally grounded only in the opinion of the small number of its proponents. As a social construct Evidence-based Medicine appears to be profoundly under-theorized. However, its reductive nature makes it resistant to theorizing. At the very basis of the construct 'Evidence-based Medicine', there is a failure to differentiate entity from process, as pointed out by Tonelli (above). As a medical epistemology, the 'evidence' of Evidence-based Medicine is presented as having a decontextualised self-evident truth such that any contextualising relational questions such as 'evidence of what?' or 'whose evidence?' or 'what evidence, when?' cannot be asked (Harari, 2001). The 'evidence', data from clinical research, which could be seen as an *entity* for use as a tool in practice, is not differentiated from the *process* of practice itself.

A basic absence of internal differentiation in the form of internal distinctions that would create or represent relations pervades 'Evidence-based Medicine'. This has consequences for both its internal functioning and its external, contextual relations. The comprehensive overvaluing of evidence, on the basis of its match to a formalism, produces a kind of 'self-evidence', which is associated with an absence of any internal relational function, with the practical consequence that relational aspects of practice are

ignored at multiple levels. The practice of medicine is defined in simplified reductive terms. The practice of Evidence-based Medicine is conflated with medical practice and medical expertise is equated with expertise in performing Evidence-based Medicine. Evidence-based Medicine only addresses practice *after* a provisional diagnosis has been made. The process of diagnostic formulation which requires the relational processes of *thinking about* alternatives, some of which will be incommensurable, is ignored. The 'problem-setting' phase of practice described by Donald Schön in his account of practice (Schön, 1995:40-41), is not addressed, so Evidence-based Medicine becomes no more than instrumental problem solving, where the practitioner is not expected to *think reflectively* but rather to *act*, as directed by the 'evidence'. No reference is made to the doctor-patient relationship. The patient's role is to supply the doctor with information and then to follow directions, as a passive recipient of 'best practice' medicine. The collegiate relations, on which medical practitioners depend and which, as I will argue later, function as a basis for the production of knowledge, are actively denigrated and the broader context of individual practice, with its issues of relational phenomena such as team, inter-disciplinary, or systems functioning, is ignored.

The reliance on internal 'self-evidence' of Evidence-based Medicine is accompanied by a concomitant neglect of relations with its external environment. Proponents do not seek engagement with practitioners or critics for feedback or dialogue. There is no reference to any of the aspects of medicine that Evidence-based Medicine is unable to address. Nor is there reference to any consequences that may follow from its functioning. Whether it meets its stated purposes of improving practice and reducing harm is not only not known, but is dismissed as irrelevant. Nor is its cost in terms of the resources diverted to it, considered, as neither individual proponents nor organisations that call for its implementation treat this as a matter of significance.

The reductionism in Evidence-based Medicine makes it conservative (Maier, 2006). Evidence-based Medicine evaluates and uses what *has* been already done and offers a blueprint for the replication of that. If it were to be actually practised as proposed and guidelines were to be faithfully followed, then medicine would be static and nothing new could be learned or practised. As a construct it is unable to account for the reality

of medicine as an ever-changing or evolving process. It is unable to address adaptation or generativity, which, I will argue in later chapters, are linked to each other and are both of central importance to a meaningful conceptualisation of practice of any kind and to learning.

In this chapter, I have made references to Evidence-based Medicine being reductionist in nature. In the following chapter I will consider the nature of reduction and reductionism and the different forms of underlying relations that support greater or lesser reduction in constructs. I am referring specifically to John Dewey and Arthur Bentley's conceptualisation of relations with their differentiation of what they called 'self-action', 'inter-action' and 'trans-action'. Consideration of relations then leads into a consideration of the different forms of system that are produced by relations, to be the subject of the further chapter on complexity theory.

CHAPTER 3 - RELATIONS AND SYSTEMS

INTRODUCTION

In reviewing how Evidence-based Medicine functions in the previous chapter, it has become clear that the conceptualisations of practice, learning and knowledge on which it is based are severely reductive ones such that functioning of Evidence-based Medicine as a practice is severely limited. I have argued that this reduction is a relational reduction, which is illustrated by the neglect of relations at multiple levels in Evidence-based Medicine. I now want to consider different ways of conceptualising relations, using the work of pragmatist philosopher John Dewey, in order to be able to re-conceptualise learning and practice in a way that is more consistent with experience. As relations cannot be separated from the systems that they constitute or produce, I will briefly review the development of theories of systems functioning in preparation for the following chapter. There I will look at complexity theory and the complex systems it describes, which, I will argue can be used in understanding practice and learning in a more realistic and productive way.

In this chapter I will examine:

3.1 The concept of reduction as a natural human activity, used in thinking and communication, social processes such as administrative functioning and scientific inquiry;

3.2 The traditional substantialist ontological framework of inquiry which is based on a *relational* reductionism, illustrated by the contrast between reduced relations and the complexity of real-world living relations;

3.3 John Dewey's conceptualisation of the basis of lived human experience as a co-ordination of the organism and its environment; John Dewey and Arthur Bentley's definitions of relations that encompasses complex, real-life relations (trans-actions) as well as relations that are reduced for specific purposes (inter-actions and self-actions) and the way in which this conceptualisation of relations underpins Dewey's understanding of life in relational terms;

3.4 Deweyan relations in human processes: generativity and ethical functioning;

3.5 The link between relations and systems preparatory to expanding on living complex systems in the following chapter.

3.1 REDUCTION

Reduction and Reductionism

In the last chapter I made reference to the limitations of Evidence-based Medicine as following from the reductionism in both the definition of 'evidence' and in the way in which Evidence-based Medicine is conceptualised as a practice. This reductionism arises from the belief of Evidence-based Medicine proponents that variations in practice reflect error, which can be reduced by standardising practice, and that the control introduced by this standardisation will automatically lead to improved clinical outcomes. This belief is based on an assumption that the 'individual as variable' of clinical research is the same as the 'individual as patient' in the clinical setting. It is present in the equating of quantifiable research information with the knowledge needed for clinical practice, and claims that the quantified methods of clinical research as being appropriate to the 'research' that constitutes the processes of the clinical encounter. Despite proponents' claims to the contrary, much effort in the Evidence-based Medicine enterprise has been aimed at removing subjective human experience, both that of the practitioner and that of the patient as these are a source of variation, with the aim of controlling human judgement in practice. Proponents assume that this approach to the clinical encounter will make practice more objective and hence more 'scientific', where 'scientific' is a claim to embodying a unitary, determinate 'truth' of a situation. They expect that the improved clinical outcomes of such 'scientific' practice would be both reproductively reliable and generalizable across contexts. Thus for proponents of Evidence-based Medicine, to follow its precepts is the mark of 'best practice' and good quality outcomes naturally follow.

What is meant by reductionism? Definitions of reductionism make reference to it as being 'a practice of analysing and describing a complex phenomenon, especially a

mental, social, or biological phenomenon, in terms of its simple or fundamental constituents, especially when this is said to provide a sufficient explanation' (The Concise Oxford English Dictionary, 2006). The definition of the term reduction*ism* implies that a claim for reduction is being made that is inappropriate or inadequate. Reductionism is usually differentiated in terms of the level to which reduction is being made. So, for example, a theory that attempted to explain psychological findings using neuro-physiological (biological) concepts would be described as biological reductionism. The underlying manoeuvre of *reduction* however carries no negative implication. It is to 'present a problem or subject in a simplified form' (The Concise Oxford English Dictionary, 2006). Reduction may be specified as ontological or epistemological reduction. Ontological reduction is related to entities of one domain being composed of those of another, while epistemological reduction addresses the issue of whether theories or laws of one domain can be derived from those of another (Anderson, 2001).

Reduction as an Aspect of Human Functioning

Reduction occurs at all levels of human functioning. At intra-psychic and interpersonal levels, affective human experiences must be reduced in varying degrees to concepts and words, both for internal manipulation in conscious thought and as an aspect of communication between individuals. The theories and models produced and used in any form of inquiry require reduction. Reduction forms part of the basis of social group functioning. We belong to social groups on the basis of the groups' necessarily reductive purpose. At a more macro level, reduction is feature of those aspects of social functioning where social equality is sought, in issues such as equity in justice or distributive equity of social resources. Reduction is used as a tool in societal functioning. For example, the historian Theodore Porter points out that reduction, in the form of quantification, was a practical aspect of the development of the centralized bureaucracies of nation states. Reduction can be seen in the use by administrative bodies from the early nineteenth century, of descriptive statistics, which create 'the world of accounts and budgets, of maps and social surveys, of classifications of school children, the sick and prisoners' (Porter, 2003) in the service of community needs.

Reduction as a Tool in Bureaucratic Functioning

For a bureaucracy, quantification performs a number of functions. Because of the relative disengagement from the individuals who produce, or are described by, quantified material, quantification gives the appearance of objectivity. Porter describes objectivity in this context as having a cluster of meanings related to the bureaucratic effort to remove the personal and subjective. These efforts can only provide an appearance of objectivity, because the significance of what material is selected and how it is to be quantified does ultimately rest on constrained, but still necessarily subjective, evaluations by bureaucrats. However, the presentation of objectivity allows the demonstration of an absence of prejudice or self-interest on the part of decision makers which is important where fairness or equity is concerned (Porter, 1992). Quantified material 'travels well' and so facilitates administration over distances. It reduces ambiguity by excluding the complexities of meaning. Communication using quantified material may be used to obtain agreement between parties, where different players have different understandings and goals in a situation, because numbers are more easily communicated than arguments. But such communication also has significant limitations, as the cost is that 'everyone involved has to sacrifice meanings' (Porter, 1992). Meaning is lost in the original quantification, opening up the risks of misunderstanding which will be introduced as the quantified material is variously reinterpreted at different local sites.

Reduction in Science

As well as being inherent in statistics, reduction is also a tool in the scientific modelling of aspects of the real world. This is usually described as beginning with Rene Descartes' division of mind and body, with his conceptualization of the body, 'res extensa', as material and the mind, 'res cogitans', as immaterial, and his belief that all matter in the universe is in essence, of the same type and it can be described using simple, uniform physical laws. Isaac Newton provided laws which were originally intended as accounts of planetary motion, but which were then applied generally, in what is called the 'Newtonian paradigm' which involves conceptualising the material world, at all levels, from sub-atomic, with some allowance for quantum theory, to cosmological, in terms of

particles. This reduction of the complexity of 'what there is', to particles or entities underpins the content of science and is basic to the production of the spectacular range of technology that has been derived from that science.

However, the Newtonian paradigm has limitations as it *models* the real world; it is not the real world itself. Science has been described as being based on the 'modelling relation', which involves encoding aspects of a natural system into a model, or formal system (Mikulecky, 2001). This formal system can be manipulated to elicit models of causal changes in the natural system which can then be tested against reality. Because it is based on modelling, which necessarily involves reduction, difficulties arise where the modelling relation is forgotten and the model is taken for reality; where 'epistemology spills over into ontology' (Mikulecky, 2001).The process of taking the model as the reality occurs readily. Evidence-based Medicine, where the models of clinical research are taken as the reality of clinical practice, is an example.

3.2 RELATIONAL REDUCTIONISM AND A SUBSTANTIALIST ONTOLOGY

The Traditional Reductive Ontological Framework

For social groups to be able to function in any capacity, categorical distinctions of the world, in some form, that is, distinctions in contents and processes, have to be made (Saljo, 2002). How these distinctions are made is socio-culturally shaped and in turn, this shaping constrains the range of possible epistemologies. The work of Descartes and Newton both developed out of and contributed to an ontology where particles, entities, 'things', substances, objects, particulars, are conceptualised as being 'what there is' to be considered. This paradigmatic view has been described by sociologist, Mustafa Emirbayer, as a 'substantialist' ontology (Emirbayer, 1997). It has also been referred to as a 'things' ontology (Saljo, 2002). In this paradigm, entities or substances are accorded an ontological primacy. This focus pervades and shapes Western thinking. Here relations have a secondary place. In any formal inquiry, 'systematic analysis is to begin with self-subsistent entities, which come 'pre-formed' and only then to consider the dynamic flows in which they subsequently involve themselves' (Emirbayer, 1997).

One of the consequences for inquiry within the traditional substantialist framework is that analysis leads only to more and more finely delineated entities, which can be accumulated in a quantitative summation but cannot produce qualitative novelty. Such entities are related to one another by reductive or reduced, relations. The common dualisms such as body/mind, or theory/practice, individual/social, micro/macro, or the example of stimulus/ response that John Dewey works with (which I will come to below), can be seen to be a result of reaching a limit in a substantialist ontology. Each party to these dualisms is deterministically defined as an entity. Experientially we know that each has a connection with the other, but what that connection is cannot be conceptualised from a substantialist perspective. The only option is to put them adjacent to each other, described by John Dewey as 'thing balanced against thing' (Dewey and Bentley 1949/1989: 100 -102); a 'balancing' of 'things' that forms a dualism. It can be seen that, in this context, dualism is a term which indicates a relationship between the entities but that formulation of that relationship is problematic. I will later argue that Dewey's concept of trans-actional relations and the complexity theory concept of emergence, allow a re-conceptualisation of dualisms.

A substantialist perspective is structured into aspects of the English language. This is illustrated by an example of Norbert Elias' of our use of constructs such as 'the wind is blowing', which suggest that the wind is a discrete entity first, and then secondarily may engage in the process of 'blowing' (Emirbayer, 1997). This perspective is not necessarily as prominent in all languages. In English, the subject of a sentence is usually formulated as a discrete, named entity, such as 'the wind' in the example above. This subject's relations or processes then become the predicate of the sentence, in this example 'blowing'. The focus of the sentence is on discrete entities. In comparison for example, the language of the Yolgnu people of Arnhemland is structured such that the subject of a sentence is not a named entity but is a word or words for the nature or qualities of the *relations between* named entities. So, where an English speaker may describe boats (subject) sitting on a beach (predicate), a Yolgnu speaker's subject is the *relationship* characterised by 'on-the-beachness' that secondarily happens to involve boats (Watson-Verran, 1989: 14-15).

Relational Reductionism

The dictionary definitions of reduction are given above as 'describing complex phenomena in terms of simple or fundamental constituents'. This reduction appears to be commonly interpreted in substantialist terms, as in Anderson's definition of ontological reduction as 'reduction is from more complex *entities* to simpler, more fundamental *entities* (my italics)' (Anderson, 2001). Here, what is said to be reduced are entities. An example of this might be of a brick wall being reduced to bricks. In this interpretation of reduction there is an absence of any reference to relations. By contrast, the reduction that Porter describes in his account of quantification used as a tool in societal functioning, includes reference to the removal or neglect of contextual relations, which necessarily also involves loss of the meaning that arises from contextualisation. This suggests that in considering human functioning and processes it is appropriate to consider reduction in terms of relations as well as entities.

Relations are paid relatively little attention in most fields of inquiry, including the social sciences. This appears to be because the term 'relation' is understood to refer to relations that are already reduced in form. The reductive move, from the complex real-world relations to linear relations is largely unnoticed and unreflected on, so relations, then, are commonly understood by definition to be the simplified linear relations of Newtonian mechanics. These relations function much like entities themselves. Their value or meaning is fixed and inherent. It does not depend on context and they are unaffected by time, being unaltered over the duration of the process in which they are involved. Nor does engagement in linear relations alter the entities which are party to the relationship. For example, in '1 + 1', the '+' has a fixed meaning. Neither '1' is altered in its internal integrity, by the presence of '+' nor is '+' altered by either adjacent '1'.

Real-world Complexity of Relations

However, what happens if relations are considered in their real-world complexity? Philosopher of education Paul Hager, in a paper on professional practice and learning (Hager, 1996), begins by arguing that in any account of professional performance, as

much attention should be given to relations, as to the 'particulars' of the situation being considered. (Particulars being the entities between which the relations exist.) In doing so, Hager draws on earlier work of his on Bertrand Russell's philosophy, specifically the way in which Russell accorded ontological status to relations. He looks at the significance of Russell's choice of analogy for a logical construction. For particulars in a logical construction, Russell chose as analogy notes in a symphonic performance which he contrasted with blocks in a building. In considering this analogous contrast, Hager interprets Russell's analogy as being that 'the ultimate constituents of a symphony are *both* the notes and their *relations'* (Hager, 1996) and thus his argument that in a logical construction, the relations 'are as constitutive of the phenomenon to be explained as are any of its other aspects' (Hager, 1996).

Hager takes this perspective further to look at the significance that according ontological status to relations could have. He describes the relations in a symphonic performance as having variety and complexity in comparison with those between bricks in a wall. The relations in a symphonic performance are more complex than 'merely bring[ing] together two sets of things', as in the building a wall of bricks. That is, the relations differ qualitatively, not just quantitatively. These relations 'should not be thought of as 'things' in the same way that particulars are 'things' (Hager, 1996). Hager draws attention to a central feature of the relations of a symphonic performance, which is that there is a connection between relations, as part of a whole, and the nature of the whole itself. The relations between individual notes as they are performed have a significance for the whole performance, in a way that the internal relations of a wall composed of building blocks do not have for the wall as a whole. The relations between individual notes, how their quality and timing is interpreted and performed, contribute to the production of a performance. There are multiple relations in the minds of orchestral performers, between orchestral members, and between orchestral members and conductor. These are not prescribed by the score, but they produce the multiple fleeting moves and responses that emerge during performance which make each performance an individual one. Audience expectations and responses and the social and cultural context of the performance all contribute to the production of a performance

that is unique. This performance can be understood as having been structured by its internal and contextual relations, making it what Hager calls a 'complex relational structure'. This structure is a process which 'emerges' in the unfolding of its internal relations, through time and in the context of its environment. That such a performance is unique, signals that it is a creative or generative production, not just a re-arrangement of particulars or entities already present, such as using building blocks to make a wall.

Hager's paper takes complex, non-linear relations-as-lived as its subject. It refers to the significance that 'parts', in this case these internal relations, have for the 'whole', in producing a structure that is structured by relations rather than by entities. It also points to the significance of contextual relations including time for such a structure, and to the way in which something radically new can be produced, or rather, emerge from, human processes. In doing these things it pre-figures the central aspects of what is becoming to be known as 'complexity theory' on which I will elaborate in the following chapter. But before doing so, I want to look further at how degrees of reduction in relations can produce types of relations that can be usefully differentiated. For that I want to turn to the work of the American psychologist and pragmatist philosopher John Dewey.

3.3 DEWEYAN RELATIONS

John Dewey was concerned throughout his life's work with a non-reductive way of understanding the living functioning of the human organism. His psychology encompasses biological and psycho-social perspectives in a way that does not separate them, as they have been and commonly still are separated. His perspective dissipates the body-mind dualism that has traditionally bedevilled psychologies. Dewey's conceptualisation of life is that of living organisms as being engaged in a process of 'co-ordination' with their environment, and of organism and environment in a reciprocal relationship as constituting a whole. He took as a starting point an understanding of life as being a unified whole that includes the distinction of environment and organism within itself. This distinction between organism and environment is not a given 'in nature' waiting to be discovered. It is the result of the human activity of making

methodological distinctions in the process of conceptualising and re-conceptualising subjective experience (Garrison, 2001; Garrison and Watson, 2005).

Dewey's object of inquiry is not the organism, nor organism and environment as separate entities which are then put together, but the organism-environment relationship itself. Dewey's focus is on its vicissitudes over time as an evolutionary or developmental process (Bredo, 1998). Organism and environment are differentiated, not on the basis of *substance* but on the basis of the differing but complementary *function* of each. Dewey describes organism and environment, not as entities, but as differing phases or aspects of a wholly relational process, much as one can describe an individual person as being one expression of humanity.

Dewey's conceptualisation of relations is present from his early work. It is illustrated in his account of the 'reflex arc' nature of understanding the human organism in his early paper 'The Reflex Arc Concept in Psychology' (Dewey, 1896). However it was not until his very late work on relations which resulted from fifteen years of collaboration with Arthur Bentley (Ryan, 1997) that he presented his thoughts on the nature of relations in a more abstract formulation (Dewey and Bentley, 1949/1991). I will consider firstly the basic unit of Dewey's construct of 'lived life', the trans-actional co-ordination, as outlined in his 'reflex arc' paper, and then consider Dewey's non-reductive conceptualisation of relations, outlined in the later work.

Dewey's Concept of Life as the Process of an Organic Co-ordination

Dewey points out the difficulties that follow from scientific classification systems that have left a heritage of humans seeing what are aspects of a process as separable entities in themselves. He uses the division of the physiological reflex arc into the individual components of sensory input, mental processing, and motor response, as an exemplar for the traditional conceptualisation of human experience and agency. In this conceptualisation something happens in the environment that affects the organism, it is thought about (at some level) and then, in a separate and later move, it is acted on. 'The sensory stimulus is one thing, the central activity, standing for an idea, a second thing, and the motor discharge, standing for the act proper, is a third' (Dewey, 1896: 358).

However, he argues for a re-conceptualisation of human experience and activity in functional terms, as an organic 'co-ordination' process which contains both 'stimulus' and 'response' as 'phases' of a whole process. These separated aspects should be understood 'not as distinctions of existence, but … (as) distinctions of *function*, or part played within the single concrete whole' and 'a division of labor as regards maintaining or reaching an end' (Dewey, 1896: 358, 365-6), (italics added).

Dewey's 'co-ordination' is a description of life as an on-going process. The ends of the co-ordination process are no more than the changing organism's evolving relationship with its changing environment through time. Stimulus and response have differing 'maintaining or reconstituting' roles. In Dewey's account, stimulus and response are each both motor and sensory in nature, making it clear that the traditional division of sensory stimulus and motor response is based only on those parts of the whole that we may be consciously aware of observing or experiencing. He argues that the stimulus can be conceptualised as a 'shift of focus of emphasis' in the organism's ongoing experience of its changing external environment. It can be seen that the stimulus is not a passive reception of something from the environment, but is created within the organism-environment relationship. The stimulus has no significance on its own. What it means is a product of its part in the greater stimulus-response co-ordination and needs 'to be discovered' by the organism. Its significance is as a 'phase of the co-ordination requiring attention'. It signals that a previous state of co-ordination is changing. It 'establishes the conditions of action for the response to complete the co-ordination.' So it points to the future indicating what needs to be done; what the future response may need to accomplish. The stimulus changes during the co-ordination process. It is modulated/interpreted by the organism's response to it and so is only fully 'discovered' when the response is complete. In complementary form the response is an on-going recognition/modulation of the stimulus, again directed forward in time, such that a new form of co-ordination can be established. Thus:

'The stimulus is that phase of the forming co-ordination which represents the conditions which have to be met in bringing it to a successful issue; the response is that phase of

one and the same co-ordination which gives the key to meeting these conditions, which serves as instrument in effecting the successful co-ordination' (Dewey, 1896: 370).

So, stimulus and response aspects of the co-ordination between organism and environment are not related to each other in traditional form, linear in time, as 'sensation-followed-by-idea-followed-by-movement' but are 'correlative and contemporaneous' (Dewey, 1896/1975:370). The 'sensation-followed-by-idea-followed-by-movement' is unfolded linearly along a time axis. In contrast, Dewey, in taking as his object of enquiry the relationship between organism and environment, places the stimulus-response co-ordination, at right angles, in a sense, to the time axis, so that it is the co-ordination process as a whole which moves through time.

Dewey's Conceptualisation of Relations

In his work, Dewey has a broad non-reductive conceptualisation of relations. In his concept of organism-environment co-ordination, organism and environment are aspects of the one whole. Neither exists without the other and each contributes to the formation of the other. Each is involved with the other in a reciprocal relationship. This form of relation was named by Dewey and Bentley as a 'trans-action' (Dewey and Bentley, 1949/1991). It is an evolving process, in which time is an essential factor. Participation in such a relation necessarily changes both organism and environment. Dewey and Bentley also describe two simpler forms of relationship that are the result of increasing degrees of relational reduction. These they named 'inter-action' and 'self-action' respectively.

Dewey and Bentley described relations in the following terms. (The italicised phrases are the authors' and illustrate what can be *observed* in these differing relations.) The first and most reductive relation is 'Self-action: where things are *viewed* as acting under their own powers'. The second is 'Inter-action: where *thing is balanced against thing* in causal interconnection'. These two are contrasted with 'Trans-action: where systems of description and naming *are employed* to deal with aspects and phases of action, without final attribution to independent 'elements' or other presumptively detachable or

independent 'entities'…and without isolation of presumptively detachable 'relations'' (Dewey and Bentley 1949/1989: 100 -102).

Self-action

In the first of Dewey and Bentley's formulations, self-action, relations are either apparently absent or internal to the entity and are inaccessible so no observation of them or engagement with them is possible. Concepts such as the 'soul', individual 'will', the 'mind' as 'actor' or the 'norm-following individual' are examples. So too are social groups or sequences of action such as social movements, that are believed to function 'under their own powers', apparently with no external connections (Emirbayer, 1997). An example of such a social movement, I have argued, is Evidence-based Medicine, with its non-recognition of internal or external relations. It is possible to understand these constructs as aspects of reality that have been so reduced, so stripped of relations, that what remains is something that we can only conceive of as an entity, which either acts under its own powers or is something to be acted on, in inter-actional relations described below.

Inter-action

In the second formulation, inter-action, relations between entities can be observed but they are reductive in nature. The entities are unchanged by their involvement in the relationship and the relations are simplified, having a meaning that is unchanged for the duration of the inter-action. The way the relation between a boat and the beach on which it sits, as conceptualised by English speakers, is an example of an inter-action. So is the relation between bricks in a wall (Hager, 1996) or between a marble and the glass jar that contains it (Garrison, 2001) or between water and the cup that holds it (Malpas, 2002). From an 'inter-actional perspective', even where the individual is understood as a subject, it is as a self-contained, disengaged, and atomistic or 'punctual' subject (Taylor, 1995a). This means that activity takes place between or among otherwise disengaged entities, 'much like billiard balls' (Emirbayer, 1997). Inter-actions are linked in their reduction with some of the disengaged self-acting entities referred to just above, such as the 'variable' of clinical research and sociology's 'rational actor'. Dewey

and Bentley, in defining their term 'trans-action', add in a footnote 'It should be fairly well evident that when 'things' are too sharply crystallised as 'elements', then certain leftovers, namely 'relations', present themselves as additional 'things' (Dewey and Bentley 1989:100 -102 fn). This indicates an understanding that in inter-action, the relation itself has been reduced to the status of an entity.

Inter-actions are the linear relations of Newtonian mechanics. They are the relations used in traditional scientific enquiry. They are used as a basis of statistical research, where differences in relations are 'averaged out' of existence and of empirical research where linear, causal connections are being sought, so that those aspects of the complex relations of life that are not causal are controlled for and so disappear from sight. Dewey and Bentley acknowledge the role these relations play in specific areas of human inquiry, such as scientific research, where they describe inter-actions as having a place in 'provisionally separated segments of inquiry…for convenience of study' (Dewey and Bentley, 1949/1989:103).

Trans-action

The relations of living entities in Dewey's organism-environment co-ordination process are trans-actions. Acknowledgement of a unidirectional time dimension is an essential component of trans-actions that the more reductive inter-action and self-action lack. Trans-actions are relations that evolve during the process of the co-ordination that they themselves constitute. Parties to the relationship are conceptualised as *functions* of a holistic co-ordination rather than as discrete *entities*. They cannot be specified apart from each other, as each reciprocally 'co-creates' the other, just as 'stimulus' has no meaning without 'response'. A dove has no status as prey unless it is engaged with, say, a hawk, in a predator-prey trans-action. Nor can they be specified apart from the relation in which they participate as they constitute it. The concept 'prey' contains within itself the complementary concept, or 'co-related concept' (Malpas, 2002) of 'predator'.

The relationship however is asymmetrical, in the sense that participants cannot substitute for each other. While each depends on the other to make the relationship, and is engaged in some form with the other, each is also defined as 'not the other', much

like the yin/yang concept of Chinese philosophy. Another way of putting this is that a trans-action is a relation that holds within it an internal distinction of a complementary but irreducible differentiation. Unlike inter-action, participants in trans-actional relations are changed by being party to the relationship. They are not known in a fixed way prior to the process of relationship, what they are must be 'discovered', that is, their significance or meaning unfolds and changes with the process and changes as the process moves through time (Dewey and Bentley, 1949/1989: 112-115). So, the dove only becomes a prey, and the hawk, a predator, within their relation with each other.

As with the original stimulus and response co-ordination, organism and environment can be understood as aspects of a greater whole, forming a system. The organism/environment distinction is not antecedent to the trans-action but rather emerges in the trans-action and changes during the process of it (Garrison, 2001). The organism is that 'phase of action within the larger trans-action that *acts* to maintain the moving functional equilibrium' and the environment is the 'phase that disrupts, obstructs, or sustains functioning', the phases being aspects of the trans-action as a whole (Garrison, 2001). From Dewey's perspective this larger on-going trans-action of organism-environment distinction allows 'the seeing together…of what before had been seen in separations and held severally apart' (Dewey and Bentley, 1949/1989: 112). I understand this as having a focus on relations and hence function rather than on entities and structure. Garrison illustrates this distinction of function and entity with examples such as the relation of lung function and oxygen-producing plants (Garrison, 2001) and, playfully, the human need that creates 'food' from what in other contexts is otherwise just organic material (Garrison and Watson, 2005).

Dewey's Relational Ontology

Dewey understands the engagement in a trans-actional relationship with the environment as the source of human experience. It shapes the biological or organic structures of the body producing what Dewey calls 'habits'. Habits are predispositions to perceive and respond in the organism-environment transactional relationship in individually characteristic ways (Mousavi and Garrison, 2003). They are a body/mind

phenomenon, having a biological component and they emerge from multiple experiences, becoming more structured and specific over time. They can be understood as an expression of what has been learned from experience of life which in turn, is brought to future trans-actions, acting as a guide and at the same time being further modified and developed by the process (Garrison, 2001; Vanderstraeten, 2002a). However, Dewey is not equating experience alone with knowledge. He argues that reality is what we primarily experience: 'Things are objects to be treated, used, acted upon and with, enjoyed and endured, even more than things to be known. They are things to be *had* before they are things to be cognized' (Dewey quoted in Vanderstraeten, 2002a). However, when the organism experiences incompatible possibilities in the organism-environment trans-action; where habit cannot be used as a definitive guide but where selection of possible actions has to be made, the situation needs to be thought about, an activity which in turn produces knowing or knowledge. Dewey conceptualises thinking as an investigation of the situation in the form of a symbolic experimenting, which defers action until a selection can be made. This transforms action which otherwise would be a trial-and-error activity, into intelligent action, that is, action which has meaning (Vanderstraeten, 2002a).

In Dewey's relational ontology, the meaning of a situation is something that is created within a trans-actional relationship. It is meaning that is lost when relations are reduced to inter-action or self-action. The standardization that produces the variable of empirical research; the quantification of material carried out by Porter's bureaucrats; the instructions of clinical practice guidelines; all these involve degrees of relational reduction. This simplification has practical value in that it appears to offer a measure of certainty for use in managing uncertain circumstances. The material comes with reduced complexity and therefore reduced potential for ambiguity, and increased reliability and generalizability. However it is when the material produced by these reductive manoeuvres comes to be used in human practices that difficulties arise. The material itself does not constitute a practice. It is no more, nor less, than a tool for use in practice. This means that while the original reduction in complexity has involved a loss of

meaning, use of the material in the context of new trans-actions will allow the emergence of new meaning-bearing interpretations of it.

3.4 DEWEYAN TRANS-ACTIONS IN HUMAN PROCESSES

There are situations in the field of inquiry into human practice where access to relations conceptualised as trans-actional is useful or necessary and can be used to illustrate the limitations of work within a Newtonian or substantialist framework.

An assumption that pervades the thinking in inquiry in the social sciences is that relations, where considered, are linear relations; in Dewey's terms, inter-actions. However, inter-actions in human activity can be seen to be a reductive derivation from trans-actional relations, by the specific operations which reduce the complexity of the internal relation (internal to the relationship) and de-contextualise the parties to the relation. This is done for specific purposes. For an individual, formulation of a thought in language involves reduction, as does the communication between individuals in social interactions. Reduction of relations is a methodological process in research where relations may be bracketed or controlled for during the course of the research; reduction 'for convenience of study' as Dewey and Bentley put it. However, trans-actional relations are a feature of the lived experience that gives rise to the need for thought, communication or inquiry in the first place and in turn trans-actional relations provide the meaning that is to be attributed to any thoughts, communications, or empirically gained data, as the data is re-contextualised through its use.

Trans-actional Relations as Relations of Generativity and Discovery

Relations between human individuals can be seen to reflect the range of relations described by Dewey. Self-action can be seen in the range of human circumstances characterised by non-relating. Inter-actional relations characterise social institutions and human 'roles' within them (although I will argue later that the co-present group, which is a feature of organisational functioning, is a site characterised by trans-actional relations). Individuals, to a greater or lesser degree engage with others inter-actionally. However, trans-actional relations between individuals are the generative relations from

which the qualitatively new can emerge. I will refer to this throughout this thesis, taking Dewey's trans-actional relation as a two-party exemplar of the complex relations of the complex systems that I will discuss in later chapters.

Trans-actional Relations as a Basis for Ethical Practice

Dewey and Bentley's formulation of relations illuminates the most basic of the problematic consequences of the relational reductionism of Evidence-based Medicine or other forms of 'evidence-based' practice. These are the consequences for ethical practice which are linked to the nature of the relations that underpin any 'evidence-based' formulation. A useful way of characterising practice in medicine, as in other institutionalised human practices, is that it takes as its basis an asymmetrical and fiduciary relationship. In medicine this is based in an understanding in the minds of doctor and patient. It does not have to be an enacted behaviour, and where it is, it does not have to be in the form of a one-to-one consultation. Patients in some circumstances are managed by multi-disciplinary teams; in some specialist areas such as radiology or pathology, specialists commonly do not have face-to-face meetings with their patients; and practitioners in allied disciplines share a qualitatively similar relationship with patients. The relationship is contained by the joint understanding by doctor and patient, of the meaning of the engagement, whatever actions may or may not be taken. The professional relationship between doctor and patient, like that between teacher and student, lawyer and client, or priest and parishioner, is not an instrumental inter-action. It is a trans-actional relationship. The doctor brings a need to work creatively, an interest in the patient and their problem and a range of material, both explicit biomedical knowledge and experientially learned knowledge, to use as tools in the encounter; the patient brings a need for something, which may still be unformulated. The purpose of the meeting is realised as a trans-actional engagement in which agreement about what the patient is in need of is jointly to be arrived at, so that later decisions about what can be provided and how, can be made. The trans-actional relationship of a medical consultation involves a form of joint problem setting, for later use in problem solving (Schön, 1983: 40).

The asymmetry in Deweyan trans-actions does not reflect inequality between the participants. The functioning of participants in these relations is both asymmetrical *and* mutually dependent, giving rise to a *functional* equality rather than a substantialist, entity based equality. This latter depends on both parties being or having, 'the same'. Some aspects of human processes are necessarily based on substantialist, instrumental relations: Deweyan inter-actions. Relations between institutions and organisations and the individual human are characterised by these relations. They are what underpin social equity. They are an aspect of a medical consultation in that each party to the consultation has a delimited role. However, what gives relations between doctor and patient, or between teacher and student, the ethical significance they have is that such relations are fiduciary in nature, that is, they are based on *mutual* reliance and therefore the need for trust. The need for trust in relationships arises where the relations are functionally asymmetrical; where parties to the relationship each need the other party but have differing functional roles.

In medicine this relationship is best understood as a shared agreement that the doctor will give advice or act, in the interest of the patient's health needs and, in a complementary way, the patient will rely on the doctor to do this (Lancaster, 1997). This reflects the asymmetric but mutually dependent aspect of a trans-actional relationship. What the patient's best interest *is*, is something that is mutually discovered in the trans-actional relationship of the consultation; it cannot be known beforehand. However the assumption in Evidence-based Medicine is that the 'evidence' determines what the patient's best interest is. This leaves doctor and patient engaged in a symmetrical inter-action, where trust is irrelevant. Here the doctor's role is reduced to the instrumental 'application of evidence' and the patient's role is to be the passive recipient or 'consumer' of 'evidence'. Understanding the nature of practice in this way changes the ethical considerations of practice. It moves the focus of ethical concerns from the practitioner-patient relationship, and the role of the practitioner within such a relationship, to the more reductive view of the functionally disengaged practitioner of utilitarian models of medical ethics that do not fit well with medical practice (Slowther, 2004; Kottow, 2007; Gupta, 2009). This is illustrated in the small amount of research on

how Evidence-based Medicine is and is not used in actual practice, referred to in the previous chapter. This material makes it clear that practitioners view their participation in the therapeutic relationship as more significant to their practice than 'technical correctness' and that patients commonly want, or are in need of, something that by Evidence-based Medicine's standards is not technically correct. Attention to this in the clinical encounter is the only way to come to a satisfying outcome (Tomlin et al., 1999; Freeman and Sweeney, 2001; Tracey et al., 2003; Gabbay and le May, 2007).

3.5 RELATIONS AND SYSTEMS

I want to consider the relationship between relations and systems. The concept of relation refers to linkage or connections between entities and this in turn invokes the concept of systems, which encompasses both entities and relations. In a sense the two cannot be separated as a definition of system illustrates. A system is 'a set of things considered as a connected whole' (Chambers, 1983) so, the 'things' are related to each other. It is only by taking a reductive substantialist perspective that we can separate 'relation' and 'system'.

With inter-actions, the entities that are party to a relationship engage with each other mechanistically and the systems that result from inter-actions are mechanical or mechanistic systems. Parts of the system can be isolated from other parts, and their functioning examined separately. Because the significance of time is minimized, nothing happens in the system that is irreversible, at least in theory, so such systems can be used for discovery of causal connections. Such a system is the sum of its parts.

As described above, parties to a trans-actional relation are engaged in the process such that they change as it changes. Dewey describes such parties as 'phases' of a larger, holistic process. The relationship between the parties is such that each co-creates the other or is defined in *non-reductive* relation to the other. Examples are stimulus and response, predator and prey, teacher and student, mother and infant. So, another way of conceptualising trans-actional relations is to see the larger whole process as a system with internal non-reducible distinctions. The predator-prey relation forms such a system. Throughout the process of their engagement both predator and prey have a common

future-directed focus on a potential meeting point. But there is also a distinction between them in the form of the predator's need for the prey to arrive at that (ever changing) point and the prey's need to avoid that same point. The parts of this relation cannot be summed and it functions as a system that is not just more than the sum of its parts but one that is qualitatively different to any sum of its parts.

A trans-actional relation functions as both a system and a relation. As a whole it can be conceptualised as a system, one which has at its core a distinction: the distinction of 'this' *and* 'not this'. As a relation, it is one where parties engage with each other in an evolving relationship, where each provides the 'environment' for the other and where participation changes the engaged parties. Trans-actional relations are the hallmark of living systems. In order to consider living systems through what is known as complexity theory in the following chapters, I will briefly sketch the development of thinking about systems.

General Systems Theory

Theories about systems, like theories of relations, are relatively abstract. This enables them to function at a meta-theoretical level such that they can be used conceptually across disciplinary boundaries. Current thinking about systems follows the work of the biologist Ludwig von Bertalanffy who developed what he called 'General Systems Theory', with just this aim. General Systems Theory defines a system as encompassing both its component parts and the relationship between the parts that make up the whole, providing a conceptualisation of systems that applied to system functioning independently of subject domain, allowing links to made between disciplines (Lewis, 2005; Heylighen, 2005). Within the Newtonian framework, systems, such as the planetary system, are essentially closed systems. A significant development in understanding was made by von Bertalanffy, when, in the 1960s, he differentiated between such closed systems, and the systems of living, biological organisms which are open to their environment. While closed systems do not relate to their environments, open systems do, exchanging material, energy or information across the boundaries that separate them from their environments (Heylighen, 2005). Living, organic systems

depend on being able to make exchanges across permeable boundaries with their environment, to take in nutrients and to excrete waste products (Vanderstraeten, 2000a). But, a consequence of openness for a system is an increased vulnerability to the impingement of disturbances from the environment.

Cybernetics

'Cybernetics' is a term coined by Norbert Weiner in 1948, from the Greek 'kubernetes' meaning 'steersman'. It is a field of study concerned with change, regulation of stability and communication in complex systems (Scott, 2001). In work in this field in the 1960s, Heinz von Foerster proposed that a first order of cybernetics, concerned with 'observed systems' could be distinguished from a second order, which was concerned with 'observing systems'. First order study takes place within the traditional substantialist paradigm. Here, the focus is on the system being observed as if objectively, and the observing relation itself is bracketed out of consideration. However, in von Foerster's formulation, this first order function can be seen to be nested within the second order study of an 'observing system' where the object of inquiry is not just the observed system, but the system and the relation between system and its environment, including the observer. This becomes an observation of a relation (between system and its environment) rather than an observation of an entity (the system). This second order observation can provide new information, but it can never be fully determinate because there is an infinite regress of observing observations, which in turn can be observed.

For an organism to survive its vulnerability to the environment, it needs to be able to instigate some form of internal change that will allow it to adapt to external environmental changes. To do this it needs to 'observe', like a third party, the relation between itself and the environment and thus the outcomes of its own actions on the environment. If it is able to do this, it is functioning as a second order cybernetic system. Such systems, being able to use informational feedback about the results of their own actions, are able to 'act purposefully' in order to both maintain their identity and to adapt to their environment as needed. Because the changes are instigated from within the system and are effected internally to the system, this process is described as

self-organisation. The human capacity to think reflectively, a developmental achievement which individuals make to a larger or smaller degree, can be understood as a capacity for second-order observation.

This concept of observing systems can be seen in Dewey's concept of the trans-actional relating of living organisms. In trans-actional relations an organism that is party to the relation is changed by its participation in that relation. But in a trans-actional co-ordination this is not a passive change; it is not just a matter of being 'acted on' by the other party. As it maintains the co-ordination with the other party, the organism makes internal changes that meet its own needs, but it does so in the light of the other party's anticipated moves. A hawk adjusts its flight path in relation to its expectations about moves that will be made by the dove it is pursuing and the dove similarly makes moves in relation to the hawk. It is in this way that an organism comes to know its environment. It does this by an iterative mechanism of undergoing the experience of engagement with the environment in a transactional co-ordination then making the internal changes necessary to survive and pursue its own interests in the external world. Thus the organism learns about the external world by observing its own relation with the external world through changes internal to itself.

However, even with second order cybernetic functioning, the issue of how the organism is able to maintain its own integrity in relation to the environment is not fully clear (Vanderstraeten, 2000a). How does it protect itself from being acted on by the environment in a one-sided manner? How does it protect its capacity to make internal changes that both manage its experience of the environment while still maintaining its own identity? For this, the concept of autopoiesis is needed.

Autopoiesis

A further theoretical development that refines the cybernetic perspective and is specifically related to living entities is the concept known as 'autopoiesis', a term meaning 'self-creating'. In the 1970s biologists Humberto Maturana and Francis Varela described the systems functioning of living systems as being differentially open and closed. Autopoietic systems are open to the environment for the import and export of

necessary materials and waste, but closed in relation to internal functioning, that is, their functioning is 'self-directed'. The system is 'informationally closed' (Vanderstraeten, 2001a). This informational closure allows the system to produce and re-produce itself from imported materials but without being directed by imported information. Maturana used the term autopoiesis for the self-referential nature of such systems. A commonly used illustration is that of a single cell. The cell imports materials and energy that it needs but its internal organismic functioning is not directed from the outside, but managed by the cell itself. Over its lifetime, the cell makes and remakes its own cellular components, including those containing the information necessary for this process. In turn, it is the producing and reproducing of these components that *is* the central functioning of the cell. Cells have no 'purpose' other than to live. While they need to import raw materials, they do not import life. The dynamic, ongoing, production and reproduction of the organism can be understood as a definition of life (Vanderstraeten, 2000b). I will return to the concept of autopoiesis in relation to complex living systems in the following chapter.

3.6 CONCLUSION

In this chapter, reduction has been conceptualised in terms of reduction of relations. John Dewey's work illustrates his understanding of the essentially relational nature of human existence and led to his more abstract conceptualisation of relations in work with Arthur Bentley. This conceptualisation begins with the complex relations of life and his trans-actional relation can be seen as a two party exemplar of these complex relations. Complex, live relations can be acted on reductively to produce inter-actions and self-action. Inter-actions are the familiar conceptualisation of the linear relations of science and statistics. They are the relations used to characterise the interactions of non-living entities of the natural world and of the living but 'generic human' of social inquiry's 'rational actor' or 'variable' of social research. In turn, self-action involves further reduction leading to the loss of context, and so leaving a form of relation that is not epistemologically available, as it is internal to an entity that then functions as a 'black box'.

In the following chapter I will to take up the issue of what a relational ontology might entail by reviewing a formulation of the complex relations of living organisms as part of ‘complexity theory’ and looking at the complex relations and the complex systems encompassed by this theory.

CHAPTER 4 - COMPLEXITY

INTRODUCTION

In this thesis I have discussed Evidence-based Medicine as an example of a social phenomenon which illustrates some of the limitations of social inquiry based in a substantialist framework. I have claimed that its failure as a practice and as an account of learning is related to the reductionism in the underlying theoretical assumptions. I have conceptualised this reductionism in terms of relations, as a 'relational reductionism', using Dewey's concept of differentially reduced relations: trans-action, inter-action and self-action. I now want to provide some depth to the claim that models of learning and more broadly, the conceptualisations of human functioning that are most commonly used in the social sciences, are unnecessarily limited by the reduction inherent in the substantialist ontology within which they are framed. I want to do this by linking relations, defined broadly as complex relations, for which Deweyan trans-actions serve as an exemplar, to a systems perspective of human experience and social functioning. This will allow me to make comments on what features can be considered for a broader understanding of human functioning that may more closely fit lived experience. The systems perspective that I am referring to is derived from a field of theories that is covered by the umbrella term of 'complexity theory' or just 'complexity'. The purpose of this chapter is to provide a basis for the next two chapters where I will look at how complexity can be used to think about life, with its respective social and individual perspectives.

Complexity theory has ontological as well as epistemological aspects. In this chapter I want to illustrate how a complexity perspective dissolves the ontology-epistemology dualism where 'knowing' as an activity, is separated from the 'entity' that is known. This happens, not by reducing of the concepts of ontology and epistemology to a merged whole, but by using a relation-based functionality as a framework rather than the traditional substance or entity-based framework.

In this chapter I will address the origins and general features of complexity with:

4.1 A brief comment on why complexity should be considered for use in the social sciences;

4.2 A reference to the historical origins which give it its shape as a body of theories;

4.3 An outline of the two broad strands of complexity: 'deterministic complexity' which has its prime place in the epistemology of complexity as 'hard science', and the broader 'non-deterministic complexity', general complexity' or 'complexity thinking', which provides a more useful onto-epistemological framework for the social sciences;

4.4 An elaboration of some complexity concepts which are derived from deterministic complexity and which function as constraints and affordances in complex systems;

4.5 An elaboration of complex systems, as a useful way of approaching non-deterministic complexity;

4.6 A return to the issue of why I consider complexity as an onto-epistemological construct.

4.1 WHY CONSIDER COMPLEXITY FOR INQUIRY?

Perhaps somewhat surprisingly for a body of theory, complexity often provokes an emotional response, usually of interest or excitement (Suteanu, 2005; Schultz, 2007). Complexity can induce a sense of coming across a new perspective on something that is also recognizably familiar. I think that this is because complexity provides a description of what *is* familiar to every individual, to do with the qualitative 'feel' of lived life, with its mixture of the familiar and the new, its surprises that shock and those realisations that retrospectively make sense of an experience, and the general messiness and uncertainty that accompany life's pursuits.

As a field of theories, too, complexity is experientially messy to deal with. What complexity offers is not something definitive (Cilliers, 2001; Cilliers, 2002) but a perspective with internal contradictions, differences and limitations that have to be

accommodated in using it. However, that it itself is complex, and not fully determinate, makes it a useful body of theories for considering complex aspects of life in the world. Some situations of inquiry, such as those commonly encountered within what can be called 'hard science', are best managed using reduction as a tool. In other situations, such as those with psychological or social import, where meaning and values are at issue, there is a need for a complex instrument to meet the complex processes of the object of inquiry.

The reason for considering complexity in this thesis is that it provides depth to the understanding of human processes, such as the learning that arises from practice which is the thesis focus. It addresses some of the epistemological problems raised in the use of current perspectives of inquiry. It allows a re-conceptualisation of the dualisms or dualities, such as body-mind, individual-social that are a feature of traditional substantialist perspectives, but it does so without the alternative of a merging of dualities in a 'reductionism to the whole' (Price, 1997). It offers an account of why, in the living and social world, many things 'happen' that cannot be understood using traditional linear, causal models of functioning. Most importantly, it offers ways of conceptualising two profoundly significant aspects of life: the qualitative novelty of generativity or creativity and the absolute limits of knowledge and knowing, neither of which can be adequately addressed from within a substantialist perspective. The capacity of complexity to function in these ways means that it can be considered as a basis for new social science methodologies.

There are three central aspects to complexity as an onto-epistemological framework for human experience and understanding, in and of the world. The most basic is that complexity takes *function* rather than *substance*, as an ontological basis. This then allows an exploration of function through a consideration of relations-based systems:

1. Complexity is a way of conceptualizing *function* or *functionality* as ontology. This entails the use of an epistemological framework which allows for the consideration of qualitative systems characterised by their processes, contextualised by time and with a focus on their internal and external relations.

2. Complexity takes relations rather than entities as a basic unit of inquiry and further, takes relations in their broadest non-reduced form, complex relations. This means that the systems associated with complexity are structured, not by entities, although entities form part of the system, but by the patterns of relations in the system. These patterns of relations make up the structure of the system, a process which continually evolves through time.

3. Complexity is capable of addressing the systems characterised by patterns of relations, and is able to account for the 'production' of new patterns of relations, a process known as emergence. Complex systems are systems where the whole is not so much more than the sum of the parts but rather something qualitatively different from the sum of the parts. With such systems, something vital to the system is lost when the system is broken down into component parts as part of a process of inquiry. This is because, as previously outlined, conceptualising a system in substantialist terms, as being composed of entities, results in the reduction of its intrinsic relations to linear relations, or Dewey's inter-actions. Complexity can be used to consider complex relation-based systems as it addresses the relations between the parts, between the parts and the whole and between the whole and the system's environment.

4.2 THE HISTORICAL DEVELOPMENT OF COMPLEXITY

Complexity theory is an umbrella term. Complexity theory is not a discrete formulated theory. Rather, it is a field of theories, from which some coherent foci are emerging, while it is itself in an evolutionary transition. Its various aspects are derived from a wide range of research and philosophical areas which include: neural network theory (McCulloch and Pitts) and artificial intelligence; cellular automata (von Neumann); self-organisation in physical systems (Haken); work on the emergence of order, currently the focus of work of the Santa Fe Institute (Kauffman, Holland and others); information theory; general systems theory (von Bertalanffy); cybernetics (Weiner, von Foerster); non-linear mathematics and associated chaos and catastrophe theories; the 'far-from-equilibrium' work on thermodynamics (Prigogine); ecological, evolutionary and

developmental areas in the natural sciences such as geography, including human geography, and the biological sciences; philosophy, particularly philosophy of science, in the work on an aspect of complexity known as 'emergence' that has its origins in the 19th century; and the social sciences, particularly the organisational and management fields (See Goldstein, 1999; Manson, 2001).

A proposed reason for the coming together over complexity of disparate science disciplines has been related to the suggestion that various areas of modernist science are reaching the limits of their capacity for generalization, limiting their potential for further usefulness (Mikulecky, 2006). Modernist science is deterministic in nature. Its functioning is based on the assumption that pre-existing 'laws' govern everything that constitutes the universe and that these laws can be determined and then used in producing certainty of findings and for prediction. The specific areas in science where complexity needs to be considered are points in the overall enterprise where indeterminacy is significant. These are points where aspects of the complexity in the situation at hand either cannot be ignored or removed by methodological means without significant distortion of the inquiry, or where it should not, as it is relevant to consideration of the particular subject matter, such as for example, where time or timeliness is an inherent feature of the subject of inquiry, as, say, in developmental science. Areas such as these, reach beyond the capacities of Newtonian dynamics to contain them (Mikulecky, 2006; Agar, 2007). At the same time, the availability of non-linear mathematics and the increasing availability of computational capacity as tools have made the development of complexity theory possible (Heylighen, 2006). The initial use of complexity concepts in hard science has been followed by their uptake in the social sciences. This is illustrated by the way in which the academic literature of sub-disciplines in the social sciences currently features special issues of journals entitled 'Complexity and (sub-discipline)'. These explorations of complexity's potential usefulness reflect the interest that it currently engenders.

4.3 DIFFERENT CONCEPTUAL PERSPECTIVES ON COMPLEXITY

Because of the developmental background of complexity, there are overlaps and contradictions in the concepts and in the terminology that is used in relation to it. The different aspects of complexity are of differential importance, depending on the particular disciplinary field in which they are deployed (Manson, 2001). This makes it important, when using the term 'complexity', to say something about how the term is being used. The literature on complexity suggests that it can be used in two broadly different ways. One can be termed deterministic complexity. This theory is derived from 'hard science' and still fits within a Newtonian framework (Mikulecky, 2006). The other is non-deterministic complexity or 'general complexity theory' (Heylighen et al., 2005), also described as 'qualitative complexity' (Smith and Jenks, 2005) 'critical complexity' (Midgley and Richardson, 2007), or 'emergent complexity' (Funtowicz and Ravetz, 1994). This understanding of complexity is of a more broadly encompassing phenomenon that can be understood as a feature of all aspects of the world and our experience of it. In what follows I will treat deterministic complexity as if it differed categorically from complexity more broadly defined but, given the ultimate indeterminacy of all aspects of the world, both animate and inanimate, this usage functions as a device to illustrate points that I want to make about complexity as it is currently conceptualised.

Deterministic Complexity

Deterministic complexity can be conceptualised as a methodologically differentiated sub-field within complexity, abstracted from the broader field of general complexity which 'contains' it, to produce tools for specific areas of inquiry such as the randomised controlled trial or statistical methods. It belongs within a substantialist framework because it is characterised by relations which are abstracted by reduction from the broader range of complex relations.

Much of the initial input into complexity theory comes from mathematics and the natural sciences which, as outlined previously, work with reduction, within a substantialist framework. The introduction of high speed computing and the

development of non-linear mathematics has allowed the algorithmic resolution of systems composed of non-linear relations that were previously too complicated to have been amenable to analysis. This has allowed for a better accounting for many of the unpredictable aspects of the world, such as weather patterns, sand dune formation, patterns of stock market fluctuations and the likely spread of viral epidemics etc. through the use of powerful top-down modelling. Because these are complex systems, 'accounting' here does not necessarily mean the certain establishment of causal connections and hence assurance of predictability, but rather patterns of possible and probable outcomes of processes. However, the work that produces these new findings does not itself reflect something paradigmatically new. It belongs within the traditional substantialist Newtonian paradigm, with its necessary reduction of relations. It is best understood as the use of a new technological tool in the *revealing* of aspects of non-linear dynamics that were already present but not previously known about, rather than as a model for the *emergence* of something qualitatively new (Mikulecky, 2001).

Its practitioners regard deterministic complexity *as* 'complexity' or 'complexity science' (Mikulecky, 2006). However, where it is understood as a sub-field within a broader definition of complexity it is described as 'computational complexity' or 'deterministic complexity' (Manson, 2001), 'reductionist complexity science' (Richardson and Cilliers, 2001), 'thin complexity' (Strand, 2002), 'simplistic complexity' (Byrne, 2005), 'restricted complexity' (Morin, 2006) or, where the focus is on the concept of emergence, 'weak emergence' (Bedau, 2008). That there is a range of terms for deterministic complexity reflects both the fact that it is the result of a methodological distinction and that making such a distinction, between deterministic and general complexity, is of relatively recent interest, so no agreed terminology has yet been settled on. However, the choice of terminology that is used for deterministic complexity implies that it can usefully be understood as a sub-field of general complexity. It is nested in general complexity, rather than the two, deterministic and general complexity, being equivalent alternatives.

The systems best accounted for by deterministic complexity belong to the natural world, such as for example, the formation of a sand dune from multiple grains of sand; or the

functioning of the estuary system of a river continually changing under the influence of river flows, tides, and coastal structures; complicated insect colony behaviours; or to large scale social processes involving human behaviours like traffic jams, the spread of epidemics or migration patterns. These systems have been described as 'complicated' to differentiate them from living complex systems, such as the functioning of the mind or of the social systems, co-present systems, which emerge from localised interacting of individuals. These systems are based on living non-linear relations which are inherently not amenable to algorithmic analysis (Cilliers, 1998; Cilliers 2000a; Mikulecky, 2001). Alternatively, deterministic complex systems are described as producing various forms of 'weak' in contrast to 'strong' emergence (Bedau, 2008). In this thesis I will use the term 'deterministic complexity' where I wish to distinguish that aspect of complexity that can be characterised by potentially algorithmically analysable relations.

This differentiation on the basis of the underlying relations of the system raises a further terminological problem in the form of how to differentiate between relations that are non-linear but potentially analysable and which produce deterministic complex systems, from those non-linear living relations that are not analysable and that characterise living complex systems. In considering the use of complexity thinking in understanding human functioning, particularly differentiating between distinct but mutually dependent psychological and social functioning (which will be elaborated on further in later chapters), this differentiation is of conceptual significance. In Dewey's conceptualisation of relations, trans-actions are the relations that contain an internal distinction so I will use 'trans-action' as an exemplar of non-linear living relations, leaving Deweyan 'inter-actions' to represent the non-linear relations of deterministic systems. (There is, of course, the further issue that underlies any problem of terminology, which has to do with the grounds on which a differentiation on the basis of algorithmic analysis can be made. Since this ultimately cannot be determined, the decision to use such a differentiation is a methodological one.)

Deterministic Complexity in Social Science

Ideas from deterministic complexity are commonly found in the literature of the social sciences, such as the areas of management or organization science, in the form of metaphors. Thus, in much of the management and organization literature on complexity there are accounts of organizations working 'at the edge of chaos' or being in a 'far-from-equilibrium' state, or management strategies for engineering a 'fitness landscape' (Zhichang, 2007). Here, the technical terms can only have a metaphorical or analogous meaning. Some writers from the social sciences understand complexity as just this. It is an 'offering of images and metaphors that are enabling for social researchers' (Kuhn, 2007). However, opinions about the use of deterministic complexity concepts as metaphors range from the argument that this can be useful if it provokes new thinking about a situation (Lissack, 1999) to its dismissal as 'pseudo-science' (Phelan, 2001). This leaves a significant on-going debate about whether, and how, complexity concepts largely developed from within natural science can be used in the social sciences and where this use is metaphorical and where technical (Maguire and McKelvey, 1999; Lewis 2000; Fuller and Moran, 2000; Richardson and Cilliers 2001; Mingers, 2002; Harrison et al., 2006).

The value of an analogy lies in its capacity to illuminate aspects of what is under consideration. However, much of the social sciences literature where concepts from deterministic complexity are used, even how use of the concepts is meant to function as analogy, is not clear. What does it actually mean to say that an organization is in a far-from-equilibrium state? How is fuzzy logic related to social functioning? A number of writers use complexity concepts from mathematics, physics or chemistry as metaphors with what seems to me to be a very tenuous link with their respective subject. Examples are the linking of fractal geometry with educational research (Davis and Sumara, 2005), or the relating of Planck's constant to the history of a corporation (Hodge and Coronado, 2007), or the elaborating on Prigogine's dissipative systems in thermodynamics before turning to Marxist theory and global social systems (Urry, 2005). This use of deterministic complexity terminology can be understood as reflecting an unformulated sense that these writers may have, that there is something in

complexity theory that *is* relevant to the social sciences that is difficult to express, but there is now a recognition that thinking about complexity needs to move beyond the metaphorical stage (Horn, 2008).

The current interest in complexity has largely emerged from work done within the disciplines of the hard sciences as described above. These sciences characteristically have a methodological emphasis on control of context and have historically neglected their own social contextuality and thus produce a relatively decontextualised, mechanistic perspective on complexity that is appropriate to their internal disciplinary purposes. While the interest in complexity has been stimulated by the work in the hard sciences, work needs to be done in order for it to be possible to think about its use in the social sciences. It will be necessary to think, not just narrowly about how concepts in deterministic complexity may be used to examine social functioning, but also more broadly, about what perspectives a broader conceptualisation of complexity would make available for fruitful use in the social sciences. Deterministic complexity, from its place within a Newtonian framework, contributes to social research, in being used in understanding large scale social phenomena. However to use complexity to think about individual human or small co-present group phenomena or the intersection between these and large-scale social phenomena, complexity needs to be conceptualised in a less reductive way than it commonly is. It needs to be considered as a pervasive feature of the world's functioning (as understood by us), including all aspects of human experience, rather than as what is offered by the narrowed view through a hard science 'lens' of deterministic complexity (Richardson and Cilliers, 2002; Mikulecky, 2006).[4]

General Complexity

Relying on the limited concepts of deterministic complexity brings a narrowness of perspective to inquiry, just as reliance on a mechanistic perspective of social life is limiting. A way of describing the difference between deterministic complexity and general complexity is that deterministic complexity is a property of a complicated but mechanistic system, which, by the definition of hard science, can be observed by an

[4] Having indicated that I see deterministic complexity as abstracted from a broader conceptualisation of complexity, I will use the term 'complexity' or 'general complexity' (Heylighen et al., 2006) for the latter.

external observer. More broadly defined, general complexity is a property that *includes* the relationship between system and observer (Strand, 2002). The inclusion of the relationship between system and observer in this description underlines the relational basis of complexity. Inclusion of system and observer together makes a different system, one that encompasses them both and the particular relation between them. Observation of this new system of 'system and observation of system' makes a second order cybernetic system, referred to in the previous chapter. The term 'observation', as well as referring to a live activity, can be used in abstract form to mean a mechanical or theoretical noting or recognition of an event. However, where the observation is made by a live complex system, such as an individual, a group or an organization, with its own wider complex connections, overall complexity deepens.

This description of complexity introduces a view of it that involves working from the assumption that natural and social worlds are linked to each other in complex ways and that complexity is a feature of both, making social and natural world aspects of a larger complex 'whole'. Every social, conscious human is constituted in part by a live, organic body that in turn is composed of atoms and molecules. This represents four different 'levels' of complexity: social, psychological, biological and natural, each characterised by differing internal relations. Accepting this broader perspective involves granting complexity some form of ontological status, and considering the epistemological consequences of such a move, described as 'complexity thinking' (Richardson and Cilliers, 2001). From this perspective, deterministic complexity may be understood as one perspective on, or view of, complexity. It is the reduced view made available from within a Newtonian framework and from the use of the tools of mathematics and the hard sciences.

Definitions of complexity are multiple and various. In keeping with the nature of the claim that natural and social worlds are part of an overall complex system, Cilliers makes the point that rather than attempting an a priori definition of it, complexity can best be approached through a discussion of its characteristics (Cilliers, 1998:2). This involves a broadening of the view from the limited, algorithmically derived features of deterministic complexity to a consideration of systems and relations (Manson, 2001;

Richardson and Cilliers, 2001) and the indeterminacy, uncertainty, limits and potential for generativity that come with this perspective.

4.4 COMPLEX SYSTEMS

As already referred to above, complex systems are systems where it is the relations of the system, rather than the constituent entities of the system, that are the focus of attention. The structure of a complex system is constituted by the patterns of relations within it, rather than by the object*s* that are its constituent entities (Cilliers, 2000b).

Deterministic Concepts in Complexity

Before relating complex systems to individual and social human functioning, I want first to look at some general characteristics of complex systems that are revealed in focusing on a system as a relational structure, but from a deterministic complexity perspective. They are non-linear internal dynamics, attractors, existence at far-from-equilibrium states, and self-organisation and emergence (Goldstein, 1999). There is one further systems characteristic which has its origins in biological research and is relevant only to complex living systems. This is autopoiesis which was referred to in the brief reference to systems theories in Chapter 3 'Relations and Systems' and will be elaborated on in relation to social and psychological functioning in the two following chapters.

The concepts of non-linearity, attractors and existence at far-from-equilibrium states, are ingredients of the concept of emergence, which is central to an understanding of complex systems. They are relevant to an understanding of human and social complex systems that is not limited to their use as metaphor or analogy, as described above, but also to an argument that I want to make about 'levels' of complex systems (natural, biological, psychological and social) and the traces of more 'basic' level systems seen in 'higher' level systems. In considering relations between levels of complexity, each is constrained by the 'lower' levels on which it depends and from which it emerges and in turn, may constrain the function from which it has emerged.

Non-linear Internal Dynamics

Linear relations are logically reversible, so they can be 'read' from start to finish or from finish back to start and they are amenable, at least in principle, to algorithmic analysis. In contrast, the relations of complex systems are non-linear relations which are recursive, so that output feeds back into the process of the relation, an influence which may be direct or indirect, enhancing or dampening. In deterministic complexity, the entities that are party to such relations remain, for the purpose of the relation, fixed, in that they are not changed by their participation in the relation. So, non-linear relations between grains of sand produce evolving variously shaped sand dunes but the individual grains of sand remain (relatively) constant. In living systems the complexity of the system is increased further because as well as the relations being non-linear, the parties to the relations are themselves changed in the process of their participation in the relation. So, unlike a grain of sand in a sand dune, an individual who has undergone an experience from which he or she has learned is changed as an individual.

Non-linearity of relations in a system means that changes in input to the system produce effects of unpredictable magnitude. Small changes may be magnified to produce large effects, illustrated by the so-called 'butterfly effect': that a butterfly flaps its wings in Brazil and 'causes' a typhoon in Japan (usually attributed to Edward Lorenz, unpublished). Conversely large changes may be damped down and be of minimal significance to the system. This means that complex systems are both intrinsically sensitive, because feedback can amplify sensitivity to aspects of the environment, and intrinsically stable, because, similarly, feedback can allow for self-correction (Lewis, 2000). The nature of this environment or context sensitivity is determined by constraints within the system.

Non-linearity of relations also means that the system is sensitive to initial conditions, such that small differences in initial conditions can lead over time to very different outcomes. Sensitivity to initial conditions means that causes and effects do not have the linear connection and epistemological equivalence that they have in a system characterised by linear relations. So outcomes cannot be predicted precisely but only in general terms, based on the system's attractor- determined limits. Thus, a mother will

give birth to a human baby but what facial appearance or temperament that baby will be born with cannot be predicted. It also means that complex systems cannot be directed to 'perform to order'. A classroom teacher cannot guarantee that her students will respond to a particular intervention in a particular way, although she will know that responses will not be arbitrary and she will have some thoughts about what range of responses she is likely to get. This 'range' of responses is determined by the system's attractor.

Attractors

When a non-linear equation is solved using the appropriate mathematics, what is produced is not something numerical, but a pattern, in multiple dimensions. This pattern represents the long term dynamics, or behaviour toward which the system moves, and hence is known as an 'attractor' (Capra, 2002). The 'strange attractor' of deterministic complexity is a set of values about which the system moves but never reaches, producing endless variations, the pattern of which describes the system's limits (Manson, 2001). That it is a pattern, composed of multiple 'variations on the theme' of the attractor, represents the flexibility that makes the system adaptive. That it describes the system's limits reflects the fact that while the system is indeterminate, it is not random. The pattern reflects its inherent cohesive wholeness. Continuing with living organisms as examples of complex systems, every human face can be seen as a variation on a theme, where no standardized or fully determinate representation of a face exists in life. At the same time there are outside limits, albeit indeterminate, to the sphere of activity of an attractor and therefore limits to the system. Any living organism has limits, again, that are inherent but not standardized, such as size and capacities. Trees of a particular species grow to heights that are varied but within a limited range and they have varied but not randomly varied life spans.

Existence at Far-from-equilibrium States

Natural science has been described as dealing with order and randomness, both states that are defined in linear terms and in relation to a fixed point of equilibrium. Systems characterized by *order* have components that obey the fundamental laws of science which govern the system's functioning. Knowledge of the initial conditions of the

system allows prediction of future behaviour. For systems characterized by *disorder*, statistical methods can be used to measure the average behaviour of system components, which also allows the prediction of the behaviour of the system as a whole (Heylighen, 2005). However work in thermodynamics by Ilya Prigogine addresses 'far-from-equilibrium' states that 'hold', within that pattern described above, both the stability and the unpredictability that characterises complex systems. In these far-from-equilibrium states, systems have the capacity, at points known as bifurcations or phase transitions (depending on which of the hard sciences is providing the terminology), to become unstable. This can lead to the breakdown of the current patterns of relations, internal reorganisation of the system, and the appearance, known as *emergence*, of new patterns of relations which form something qualitatively new. Another way of putting this is that a new attractor emerges (Goldstein, 1999).

Self-organisation

This refers to the increasing elaboration of internal complexity that is a consequence of the activity of complex relations within a system, over time. This organisation does not result from following rules, either from without or from within (Lewis, 2000). Rather it is just the activity of the complex internal relations of constituent components of the system, known as 'micro level' components, that drives the self-organisation. An example from deterministic complexity would be multiple micro-level grains of sand self-organizing into a sand dune. Another example might be the maturing of an individual personality with experience over a lifetime. Self-organization does not reflect internal or external directions or aims. Neither evolving species nor society can be said to have an overarching goal (Manson 2001).

In deterministic complexity, the appearance of a uniquely structured sand dune from multiple grains of sand may be regarded as an 'emergent' feature of the geographic system that produced it. However, the relations between grains of sand are amenable to algorithmic analysis, at least in theory, so while sand dunes are characterised by non-linear relations they do not exhibit *qualitative* emergence (Mikulecky, 2001). Self-

organization in *living* systems paves the way for a qualitative emergence, and I will reserve the use of the term emergence for this.

Historical Antecedents of the Concept of Emergence

While the use of complexity as a construct is as described above, a relatively new phenomenon, the concept of 'emergence' has a longer history. The term was first used by the philosopher G.H.Lewes in 1875, to differentiate between what he called 'resultant' and 'emergent' outcomes of chemical reactions. 'Resultant' outcomes were those that could be explained in terms of summation of the initial factors and were therefore predictable. 'Emergent' outcomes were those that were not summative and not predictable, such as water being an 'emergent effect' of a chemical combination of oxygen and hydrogen (Goldstein, 1999).

In the 1920s and early 1930s the concept of emergence was taken up by the philosopher of biology, C.L. Morgan. He used it to account for evolutionary development where increasing complexity could be seen to arise unpredictably over time. This increased complexity could not be described only in terms of earlier states and it came about in a 'non-additive' fashion. He used the term 'emergent evolution' for this. He described it as not representing 'the unfolding of something already in being' but 'the outspringing of something that has hitherto not been in being' (Goldstein, 1999). Other British and U.S. philosophers at this time, including John Dewey (Garrison, 2001) used the concept. That it then faded from prominence has been related to the ascendancy of positivism (Hodgson, 2000) or the limitations at the time of methodological tools for further refinement of the concept.

Describing and Defining Emergence

Emergence is the appearance of radical (Goldstein, 1999) or qualitative (Mikulecky, 2001) novelty. It can be defined as: 'the arising of novel and coherent structures, patterns or properties during the process of self-organisation in complex systems' (Goldstein 1999) or 'the coming into existence of new forms or properties through ongoing processes intrinsic to the system itself.' (Lewis 2000). It can be understood as a

general principle for explaining developmental change (Lewis 2000), learning and evolution (Capra 2002). Human engagement in processes that produce emergence are experienced as creativity or generativity.

The emergent features of a complex system appear as a result of the workings, over time, of the system to which they belong. They arise, not from the characteristics of the 'micro' level components of the system but from the interactions *between* those components (Cilliers, 2005b). (This does not mean that in general complexity the interactions may not be influenced by the characteristics of the micro level components, as in Deweyan trans-actions they are.) Emergent features appear at a 'macro' level in contrast with the 'micro' level of the system's constituent relations, or rather, emergent features constitute the macro level when they appear.

Emergent phenomena are characterised by a qualitative or radical novelty in that they have not been seen in the system previously. They have features that could not have been predicted and that are ostensive, in that they are only known when they reveal themselves (Goldstein, 1999). They are not deducible from the constituents of the system of origin. Nor are they reducible to the original constituents. They are characterised by new sets of relations and governed by new principles and laws, making a 'new relational structure' (Kontopoulos 1993: 22). Positing that different levels in a complex system are characterised by irreducibly different internal relations, means that the system as a whole cannot be meaningfully analysed in terms appropriate for one of the levels of the system (Hodgson, 2000). Thus the laws of physics cannot be used to understand living physiology; the rules that describe physiological functioning of the body/brain cannot be used to understand psychological functioning of the mind and concepts of individual psychological functioning cannot be used to describe or explain large scale social phenomena such as organisations.

Emergent phenomena are coherent, in that they have a boundedness that gives them definition and some stability (Goldstein, 1999) which is related to their 'parent' system or level of system. Emergent phenomena may themselves be complex systems. The mind, or consciousness, emerges from the micro level functioning of the socially

contextualised complex system of the body-brain. In turn, minds are complex systems which interact to produce social communications, external to any one mind, which form the basis of social systems (Luhmann, 1995).

Emergent phenomena have a qualitative novelty, but this novelty is not something random. An emergent phenomenon is both radically new and at the same time, it retains links to the micro level of the system that produced it, because what is possible as emergence is constrained by the limitations of the micro level of the system. While the emergent phenomenon's internal relations are not reducible to those of the micro level, it has properties that are consistent with the properties of its system of origin (Goodwin 2000; Holland, 1998). Thus the move between the levels of system that produces the emergent feature both preserves 'likeness' and introduces 'irreducible difference'. An individual person is both unique *and* may have physical or temperamental family resemblances. A developing organism becomes a unique adult but is recognisable as an adult form of its own species. Evolution produces new species that we could not have predicted but that none-the-less may be retrospectively understandable in terms of species-environment interactions.

The phenomenon of emergence gives rise to a generally agreed definition of complex systems: they are systems where higher-order (macro level) properties of the system cannot be explained in terms of lower-order (micro level) properties and, conversely, constituent parts of the system cannot predict what arises in the system. Living organisms have as their basic constituents, atoms and molecules, and life depends on the basic constituents, but life is more than the sum of such constituents; it is a phenomenon of a qualitatively different order and conversely, atoms and molecules, in themselves, do not predict the existence of life.[5]

[5] Throughout the discussion of complex systems, I use the terms 'micro' and 'macro' levels in a specific way. It is not the traditional sociological usage of the terms, where the terms refer to levels at which social order is visible: micro-level for phenomena which can be observed as individual activity; macro-level for collective and more general, phenomena (Nassehi, 2005). My usage of the terms is related to the need, in any discussion of complex systems, to differentiate between that aspect of a system, characterised by complex internal relations, which at least *begins*, prior in time, from what, later in time, emerges from the functioning of those relations and which is characterised by irreducibly different internal relations. This terminology is clumsy. 'Micro' and 'macro' imply a reference to size; the term 'level' might suggest a hierarchy of size, power, or value or some form of teleological order,

Autopoiesis (self-reference) and Structural Coupling

Here I want to review the concept of autopoiesis, which relates to living complex systems and which was referred to initially in the previous chapter ('Relations and Systems'). Complex systems are open systems in that there is flow of energy or material into and through the system, but at the same time the system's structure is maintained. This is known from the work on thermodynamics of Prigogine as a 'dissipative' function (Capra 2000). For example, the energy of an ocean wave moves horizontally in relation to the sea-bed, but is composed of water molecules serially rising and falling vertically. A living example is that of the body of an animal. The animal has the same body, with allowance for ageing, for a lifetime even though the individual molecules that are its constituents are turned over many times. In order to understand how a living system retains its structure in this way, while still being open to its environment in order to take in nutrients and excrete waste, it is necessary to return to the concept of self-reference or autopoiesis.

Autopoietic functioning involves a system with two aspects to its functioning in relation to its environment. The system is open to the environment for the import and export of material, while being closed in relation to its informational functioning. It is the system itself, not the environment, which is the source of the information needed to control the system's function of producing and reproducing itself. It is also the system that determines how it will attempt to use the environment, for purposes such as taking in or excreting materials. Autopoietic systems, because they have autonomous *internal* functioning, relate to their environment and to one another, ecologically. They are vulnerable to impingement by their environment and to survive they need to change internally in order to adaptively accommodate such impingement. They treat other autopoietic systems as they do any other part of their environment, as something to be lived with, linked to, resisted or avoided; to be used in an instrumental way, entirely in terms of their own requirements.

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none of which is intended. I use these terms because there is not yet, as far as I know, more appropriate terminology to describe the *functional* differences, based on relations, between the 'parent' and 'offspring' of the abstract 'parent-offspring' relationship, asymmetrical in time, which characterises emergence in complex systems.

The concept of autopoiesis has its origins in biology. It was developed to explain how biological systems can be open yet maintain their structure, so its original focus was limited to the organic functioning of the organism. However echoes of this biological autopoiesis can be seen at a psycho-social level of functioning: an organization can have a turnover of personnel while most aspects of the organization's identity and functioning continue (with some qualitative difference). Sociologist Niklas Luhmann (Luhmann, 1995) abstracted the basic principles of autopoietic systems functioning and used these with the cybernetic concept of second order observation in order to differentiate between, on the one hand the organic, biological processes of human functioning and on the other, the psycho-social processing of meaning. This will be elaborated on in the following two chapters.

4.5 COMPLEX SOCIAL SYSTEMS

The social world is composed of complex systems on different scales, evolving at different rates, influencing each other in different ways. They may have a more or less concrete locus or representation: a family; a school class; a community group; a school, a company or other organization; an institution such as medicine, education, science, the law, the global economy, which can all be understood as complex systems. Complex social systems may be formulated as processes, which may be fleeting activities: an orchestral performance; a tutorial; a marathon race, the process of interpreting a text, understanding a problem, managing a child's distress, or making a community decision. They may be abstract entities such as a language; a body of theory, like Evidence-based Medicine; or abstract concepts such as knowledge, meaning, practice or health. What all these things have in common is that they can be understood in terms of having their origins in complex relations between human beings. It is these inter-personal relations that give them life and maintain the process that constitutes them (Luhmann, 1995).

Using the 'complexity thinking' perspective referred to above in considering social systems, Cilliers argues for an understanding of the world in terms of networks of complex relations where complex systems are not an ontological given. They emerge in the face of 'all reality', as a result of our individual and collective need to deal with the

complexity and the indeterminacy of reality. Giving complex systems definition via boundaries, defining what is 'system' and what is 'not system' reduces complexity, making reality more manageable (Cilliers, 2001).

System Boundaries

To have definition, a complex system has to be contextualised or have a defined boundary. However complex systems cannot be deterministically defined because they are open systems and constituted through complex relations, so they cannot be separated from their environment in any totalizing way. The boundaries of a complex system can be defined in terms of the system's relations: what function as 'boundary relations' are formed by the way in which relations extend or do not extend into what comes to be defined as external to the system. Boundaries are not static nor concrete or physical, but functional. This means that they are indeterminate, emergent and share a lifespan with the evolving system itself (Richardson and Lissack, 2001). Because a complex system is an open system, it is affected by its environment and may need to respond to changes in the environment, so the system boundary becomes a co-evolutionary process involving both system and environment (Allen and Torrens, 2005). Boundaries both contain and constrain the system. They both allow some definition of the system giving it existence and, by separating it from 'everything else outside', they provide a needed degree of operational closure, reducing the complexity of the system and enabling it to function. If boundaries are too tightly defined, the reductionism makes the system unable to function (Cilliers, 2002). This is illustrated in the complex system of Evidence-based Medicine where a tightly drawn boundary around what is acceptable as practice leads to its incapacity to function as a practice. If boundaries are too loose, the system loses its identity, and over-inclusiveness may lead to reductionism to the whole.

Boundaries are two-sided. While the boundary of a complex system defines the system, it also defines the system's environment. Here, environment does not necessarily mean every thing that is outside the system, in the way it might for a determinate system, structured by objects or entities. Because complex systems are constituted by relations, their 'environment' is, by definition, also constituted by complex relations including

other complex systems. Complex systems have a greater or lesser capacity for mutually relating to or impinging on, each other. They relate ecologically, 'producing a pressure of co-evolution on each other' (Baecker, 2001).

A complex system boundary needs to be defined by an observer of the system, but at the same time, it is itself constituted of relations and reflects that aspect of the system's functioning that involves system-environment interaction. So the boundary of a complex system is neither only inherent to the system, nor only defined by observation. The use of the term 'observe' here means, in effect, to 'be able to say something about'. 'We can never be sure that we have 'found' or 'defined' it clearly ...' (Cilliers, 2001). The boundary arises from the complex interactions between observer/s and the process of the emerging system. The observer's definition is constrained by the emerging system and what constitutes the system is, in turn, constrained by the observer's definition. It is not possible to observe a complex system from a disengaged point external to it, described as the 'view from nowhere' (Nagel, 1986). The boundary itself is an emergent feature. So, because of the observer/s involvement in its production, the observer comes, however briefly, to form part of the emerging system and the observation, however small, comes to mark or influence the system, becoming part of the system's history and therefore of its on-going functioning.

The functional importance of a boundary is that it reduces complexity. In providing a distinction between what is 'system' and what is 'not system' a boundary provides the beginning of some working order within a defined system. At its very minimum, it allows something to be said about something, e.g. that something is 'system or not system'. However this order comes at the cost to the system, in the form of an acknowledgement of some limits. These are the limits of 'not knowing' that which is outside the system or what is an epistemologically inaccessible part of the system, such as a sub-system. Because the system is composed of complex relations, it is not possible for everything to be connected to everything and it is not possible for any participant in a system, including, as we have just seen above, any observer of the system, to 'know' the system in its entirety. (If it were possible for everything to be connected to

everything the result would be a fully saturated system, with no possibility of movement or life. Such a system would effectively function as an entity rather than a system.)

Reduction of Complexity and Contingency

Because they are constituted by complex relations, complex systems are uncompressible, which means that no complete description of the system that is smaller than the system itself, is possible. To think about, talk about, or formulate a complex system in any way involves making the distinction between what is to be considered the system and what is not or to define some aspect of the system to be addressed. Either involves leaving out aspects of the system. These moves involve a selection process which is contingent, that is, a selection which could have been made differently, and where alternative possibilities have been left out. Descriptions of a system are always linked with the perspective from which they are made and different descriptions of a system will leave out different aspects of it (Cilliers, 2005b).

Such selection produces a necessary reduction in complexity which allows the system to be able to be known or used. However, because the system's relations are complex, it is not possible to know the exact significance of what has been left out; hence some uncertainty is always a feature of complexity thinking. Complexity thinking entails acknowledgement that predictions can be made only in general and that decisions are always made under conditions of some uncertainty and are therefore limited and provisional (Cilliers, 2005a).

The Consequences of Time: System History and Memory

Time or temporality is an inherent aspect of a complex system. Each complex system has a history, which is shaped both by the system's original conditions and by what it has both done and undergone since its origins. The system's history is expressed in the functioning of the system (Cilliers, 2000; Seidl, 2007). Put another way, the system's functioning is an enactment of its own evolving history in the present. Or, its functioning is the embodiment in the present, of its memory. In this sense the 'shape' of a system's functioning *is* its own history. This history is an internal limit of the system,

both constraining and enabling. So, for example, an organisation that has been set up for a particular purpose, in a particular way, at a particular time, in particular circumstances and has existed through particular events will have limits to its range of possible functioning. So, for example, after an occupation or colonization, a nation state cannot 'go back to normal' where normal means 'the same as before occupation' as the significance or meaning of the occupation or colonization lives on in the future functioning of the state in the form of constraining or enabling factors: 'nation-building' is an impossibility.

A system's survival in its environment requires it to adapt, but the system itself only survives if, at least in part, this adaptation happens differentially in time in relation to the environment. Change that mirrors environmental change would mean that the system had no identity of its own, but, more significantly, a complex system treats environmental impingement as a potential source of information, to be taken in and used or to be ignored and it takes time for the system's ongoing functioning to determine the significance of the information (Cilliers, 2006). We are all familiar with the experience of realizing the significance of something some time after we have experienced it. What the birth of a child means to a family; what the replacement of a key person means for a working group; what the significance of an economic downturn is for a business; or what a change of government means to citizens, are all aspects of meaning for individuals (or significance for organizations), which may not be immediately obvious but may emerge increasingly fully over time. This reflects the way in which a complex system's response to environmental change happens in the system's own time. There is an asymmetry in time for system and environment which can be understood as an aspect of the definition of the system and which has significance in relation to human activity (Cilliers, 2006).

This asymmetry can be understood in terms of Dewey's construct of organism-environment co-ordination, referred to in Chapter 3 'Relations and Systems'. In Dewey's account, organism and environment, each of which carry differing but complementary information, are linked trans-actionally, forming different phases of the overall co-ordination process and making a larger 'whole' (Dewey and Bentley,

1989/1989). In a similar way, system and environment are party to a trans-actional whole which has an inherent time dimension.

Internal Distinctions

In social systems the development of increasing internal complexity over time may allow, in a 'top down' move, the emergence of subsystems, which may themselves function as complex systems. So, while a family may have produced a child and the child is part of the family, the child is also acknowledged as irreducibly individual in his own right. Or, an institution like education 'recognizes' the sub-systems that have emerged from its increasing internal self-organization (complexity), such as for example, curriculum studies or adult education. In turn, these sub-disciplines are utterly dependent on having a place 'within' education: 'curriculum studies' has no meaning outside of an educational context. But these sub-systems also have some complexity of their own that is not shared with, or 'known' by, the whole of the larger institution of education. A practitioner with expertise in curriculum studies or in adult education will have a capacity to do things that other education practitioners do not have and this is usually acknowledged by the institution.

Relations with Other Systems

Complex systems (largely) co-exist ecologically with other complex systems in their environment, where the other systems function as 'black boxes' in relation to them. Organic systems function in this way. Relating ecologically means that each system relates to other systems on its own terms, according to its own needs, and it is impinged upon by other systems in a complementary way. Large scale social systems also function in this way. An example of social system relating, involving the large complex systems of politics and economics, is that of a treasurer (political system) making a public request that banks (economic system) not use an economic crisis to adjust home loan interest rates and being ignored since the banks don't 'hear' outside the economic system to which they belong. It is within the political system's power to take a *political* action that will affect the economic system, because political and economic systems overlap at this point, so the treasurer could pass laws to prevent such an adjustment of

rates. This would be 'experienced' by the banks as an external environmental impingement, to be adapted to only for reasons of their own survival.

Some complex systems may interpenetrate each other at the micro level of functioning to form differentiated systems. Educators and philosophers may work together in a system which produces philosophy of education. Individuals usually belong to multiple complex social systems, so a family business may reflect the interpenetration of a family system and business system. However, the 'micro level of functioning' at which this interpenetration of social systems occurs is the small scale inter-personal level of functioning where the complex system of a human individual does not relate ecologically with other human individuals. There is an interpenetration of psychological functioning of individuals known to each other as specific individuals which occurs by the sharing of some aspects of human autopoietic functioning. This issue is taken up in the following two chapters, but this differentiation between social systems relating ecologically and human individuals relating to each other with interpenetration serves to illustrate that relations between complex systems depend on what are defined as the respective systems. Luhmann makes his initial differentiation of system functioning, not between individual and society, but between, on the one hand, biological and on the other, psychological and social functioning. The one creates and processes life, the other two create and process meaning, albeit using different modes of processing (Luhmann, 1995).

4.6 COMPLEXITY AS ONTO-EPISTEMOLOGY

I wish to return to the issues raised in the question at the beginning of this chapter about what complexity offers that makes it worth considering in this inquiry. Complexity allows for consideration of the significance of some issues that are ignored or hidden in a substantialist ontology because they cannot be addressed from within such a framework. These are the existence of absolute limits to the functional capacities of any system, including that of human knowing, the asymmetry of relations centred on an ontological distinction and the centrality of such relations to creativity or generativity.

Taking on Richardson and Cilliers' concept of complexity thinking (Richardson and Cilliers, 2001) allows its use as an onto-epistemological framework because, from a complexity perspective, the differentiation between ontology and epistemology loses its significance. The differentiation can be seen as an artefact of a substantialist ontology where such a differentiation has a place, but one limited to that perspective. From a complexity perspective it is no longer a matter of firstly, what there is (ontology), then secondly, how it can be known (epistemology). Ontology and epistemology are in a complex relation with each other. What you can know depends on *how* you try to understand. Other dualisms of social research, such as sociology's micro/ macro levels of functioning, body/mind, psychological/social, theory and practice and practice and learning, are dissolved as intractable theoretical problems when complexity allows something to be understood about the relation between the members of the pair. I say only *something* because complexity does not give us a linear account of the relation. Complexity offers knowledge, but knowledge that can only be situated, partial and limited. Unlike a positivist epistemology, non-knowledge, or 'not knowing' is an inherent part of knowing from a complexity perspective.

Asymmetry

A central aspect of complexity is the acknowledgement of the ontological reality of time. This re-introduces a dimension of asymmetry left out of a substantialist perspective. Historian Frederick Turner describes mathematicians as largely ignoring time and physicists as 'working with the extremely small, the extremely closed, the extremely cold (or hot) or extremely brief' (Turner, 1997) to make the problem of time manageable. Other disciplines control time by using tight links (reduced relations) between antecedent and event. However, the reality of time is that it is 'irreducible, irreversible, and asymmetrical' (Turner, 1997). The asymmetry of time takes the form of a future which is not yet known and cannot be predicted with certainty and a past which is absolutely beyond control and accessible only through memory, itself a process of the present. It means that understanding a complex system means understanding its history as it is revealed in current system functioning. Time means that events and actions cannot be undone but only, if possible, repaired; that the past can only be a

current, ever-changing account of itself in the present and that future predictions and plans are always contingent.

Limits

It is the acknowledgement of time that allows complex relations to be defined. The relations of our actual lived experience can only be considered where a time dimension is recognized. Like time, these relations can also be seen as keepers of limits. For example, where knowledge is understood only in substantialist terms, that is, as an object or 'thing', it can, even if only theoretically, be accumulated infinitely. The only limits are technical ones. If we don't know something, then it is just a matter of time and technology before we do or we could do. Where knowledge is understood as emerging from complex relations, it is limited by the limitations of these relations. Emergence is contingent, so emergence in a complex system means that there are multiple other potential emergent features or states which are never realised. Such possibilities are multiple but not infinite, because possibilities are shaped by the attractor of the complex system. Thus it is not possible to know the whole of a system. Knowing is limited by the very contextualisation that has given rise to it.

Generativity or Creativity

With complexity, the radical novelty of an emergent feature is not just that it is something that we did not know before it revealed itself, but something that we did not know that we did not know. It is the 'unknown unknown' of public discourse (Ravetz, 2006). What complexity does that is not done by other epistemologies, is to allow the concept of generativity or creativity to be addressed. By creativity I am referring to the appearance of something that is new and that is not a re-arrangement of things we already have or know, or something that we could arrive at by following directions. We can recognize creativity: a new thought or understanding of something; the production of a new life or a unique musical performance, but it cannot be formulated or explained. Creativity's role in human endeavour is often described as 'serendipity' (Merton and Barber, 2004). This is often meant dismissively as 'just chance'. Perhaps this is because the affective experience of creativity brings with it an awareness of involvement in a

process that is not controlled or directed, and so the contingency of the process is experienced. Through emergence, complexity brings surprise, which, depending on its meaning, may be a painful shock or the pleasure of stimulated interest or of satisfaction of a need.

Work within the traditional substantialist ontological framework is silent about creativity. This is because it is limited to dealing in entities and linear relations. Defined or determinate entities can be arranged and re-arranged but it is not possible for anything to be newly created (Mikulecky, 2001; Heylighen, 2005).This means that anything new can be arrived at only by a re-arrangement of what is already present. For example, until the mid 1990s there was much interest in, and research on, medical decision making and professional judgement. (This was before Evidence-based Medicine, with its deliberate devaluing of medical decision making in favour of research-based decision making, became prominent in medical discourse.) However an authoritative account of medical decision making from that time makes many unelaborated references to clinicians 'generating hypotheses' which are then followed by accounts of how the hypotheses can or should be tested. The only references to how hypotheses might be arrived at are to their retrieval from the doctor's long-term memory (see Dowie and Elstein, 1988). That is, a hypothesis was considered as an entity which must already be possessed before work can began, just as in Evidence-based Medicine, a provisional diagnosis is assumed to be in the practitioner's possession, again, before work begins. This echoes the quote, attributed to the eighteenth century recipe book writer Hannah Glasse, of a recipe beginning with: 'first catch your hare'. Empirical science is creative but its creativity does not belong primarily to the application of its methods, but rather to the antecedent and creative *discovery* of the hypotheses that it investigates and then to the creative contextualisation as investigation results are put to use.

Complexity addresses creativity in the form of emergence. A complex system is a system of indeterminate processes, so a feature of emergence is that a linear explanation of the process is not possible. While emergence is a feature of complexity which gives us some understanding of how to conceptualise creativity, part of this understanding is

that there are aspects of creativity that we cannot conceptualise, because complexity is indeterminate. Just as author Michael Frayn's character who wished to be an author could not discover *what* a writer does to be creative (Frayn, 1989), complexity does not give us 'the trick of it'. The benefits of creativity come with the cost of knowing that knowing itself is limited; that our explanations are largely post hoc reassuring constructs; that knowledge we have now is defeasible (Beckett and Hager, 2002: 187-188); that our predictions have to be tentative, and that most courses of action cannot be calculated but rely on our choices for which we have moral responsibility.

I now want to turn from a general consideration of complexity to consider how complexity concepts can be used to think about social life, in its social and individual aspects, in the next two chapters.

CHAPTER 5 - COMPLEXITY AND THE SOCIAL

INTRODUCTION

I have described complexity as providing an onto-epistemological framework that encompasses human experience with a greater breadth than that provided by the more relationally reductive, substantialist framework based on Newtonian mechanics. I now want to look at how complexity can be used to think about aspects of human life, as it is experienced individually and socially. In this chapter I want to look at aspects of how a complexity-informed theory of social functioning might look by referring to a current such theory, that of the German sociologist Niklas Luhmann. In the following chapter I will then consider complexity in relation to individual functioning. In the process of these two chapters I hope that it will become clear how complexity can be used to address the poorly theorized relationship between psychological and social functioning which is essential to conceptualising learning.

In this chapter I will consider:

5.1 The distinctions internal to human systems that create social and psychological 'levels' of functionality;

5.2 Distinctions and meaning: the concepts of information and autopoiesis in the work of sociologist Niklas Luhmann and his theory of social functioning that is consistent with a complexity framework;

5.3 Concepts and conceptual artefacts;

5.4 Luhmann's social systems: society, function systems (institutions), organisations and interactions (co-present group function);

5.5 Luhmann's account of the relationship between individual and social systems.

5.1 DISTINCTIONS AND RELATIONS IN COMPLEX SOCIAL SYSTEMS

The term 'distinction' is derived from the Latin 'distinguere', meaning 'asunder' (Chambers, 1983). A definition of a 'distinction' is that it is a form of differentiation

that confers some ontological status on the parts or entities that are differentiated or 'created' when it is made. Distinctions defined in this way are central to complexity thinking. They are both discovered and/or created at all levels of complexity. For example, observation of a complex system can reveal the presence of distinctions, such as that between micro level functioning and the macro level functioning that has emerged as a result of the workings of the system's relations over time. At the same time, to observe a complex system involves making distinctions: about what is to be observed, such as relations or entities and so what is to be left aside, or what is discovered or chosen as the system attractor and thus what is to be the system boundary.

Distinctions are what create the working parts of complex systems and therefore what makes them systems rather than unitary entities. They differentially both increase and decrease the complexity of a system. Distinction-making can be understood as the basic mode of functioning of complex systems. Making or having internal distinctions allows autopoietic or self-referential systems to observe their self-environment boundaries and hence make some observation about themselves. Somewhat paradoxically, it is by making *internal* distinctions that an autopoietic system learns about the *external* environment. As discussed in the Relations and Systems chapter, second order cybernetics tells us that systems learn about their environment, the external world, by changing internally, in response to change in the environment. So, an increase in internal distinctions in a system, or increase in its internal complexity as a self-organising response to engagement with the environment, reflects an increase in the systems 'intelligence' as expressed in its capacity to respond to its environment, that is, its adaptability. Such increased internal complexity reflects the system's 'learning' over time and expresses the system's history, since its history is composed of internal distinctions it has made in response to its environment over time.

Distinctions Internal to Complex Systems: Micro and Macro Levels

One aspect of the importance of distinctions in complexity can be seen by looking at the limitations on the usefulness of complexity, as seen in social science accounts of

complexity when the distinctions that produce differentiated micro and macro levels of functioning are hidden or overlooked.

Micro and macro levels of complex systems are contained within the one system, but are ontologically distinct levels because they are characterised by different internal relations. For example, the body and the mind are one entity but with two irreducibly different levels of functioning, characterized by different relations and analysed using different tools. The internal distinction may also be present as a not-yet-realized capacity inherent to the system. Because complex systems have a time dimension, this capacity does not depend on its realization for its ontological status, as it would in a system in a substantialist ontology where structure is based on entities. Complex systems are composed of complex relations and living complex relations, over time, have a capacity for the generation of emergent features, which are ostensive (Goldstein, 1999), that is, they cannot be predicted with certainty and can be known only *when* they show themselves, as outlined in the previous chapter 'Complexity'. This capacity is reflected at the systems level by the system having the capacity for internal distinctions, realized or not (or not yet). It can be described as a distinguishing feature of living complex systems, making them systems that 'hold' or 'contain' internal distinctions.

The Differentiation of Micro and Macro Levels Overlooked

In much of the literature on the use of complexity in the social sciences this feature of complex systems, that they are characterized by internal distinctions, is overlooked. Often there is a failure to distinguish between the micro and macro levels of the system, or put slightly differently, between the complex system and what is emergent from it. This is because, I think, we are used to thinking of systems, and to thinking more generally, from within a substantialist framework where relations are determinate. This means that distinctions internal to living systems, that are necessary to understand how the system can produce emergent novelty, do not exist. This neglect of internal distinction is also fostered by the varied usage of the term 'complex system'. This term is sometimes used, as I am using it here, for a system conceptualized as having micro and emergent macro levels internal to it. However, in the social science literature on

complexity the term ‘complex system’ is also commonly used for one or the other of these levels taken individually and here the concept of internal distinction disappears from view. So, for example, much of the literature dealing with the complexity of social systems takes a social entity, such as a company or a work group, and treats it as a functionally homogenous, whole system. What is lost is that the organisation as a whole may have emerged from the workings of a small decision-making group that is not co-equivalent to the emergent organisation. Conversely, a work-group may have emerged from an organisation as a whole as a sub-group, with different internal relations and therefore different capacities from those of the organisation as a whole.

In considering systems conceptualised in this way it is important that the capacity to make internal distinctions informs the way in which they are used. One reason for this is a practical one. Dealing narrowly with an organization as a one level entity may be appropriate to the purpose at hand. However, because the concept of distinction is not immediately apparent does not mean that it is insignificant. Understanding that the complex system being worked with has a micro level as well as a macro level, means it is possible to consider aspects of the system which may not be seen from the perspective of the other level. As described in the outline of complex system functioning given in the previous chapter, the micro level functioning of a system constrains possibilities at a macro level. Some of these micro level constraints will not be visible. So, for example, starting with the macro level of an educational seminar, the shared professional perspectives of attendees at such a seminar, perspectives which contribute at a micro level, will constrain what is understood of what is presented and how, by a seminar speaker, and thus the outcomes of the seminar. However, there will be constraints present at the micro level which are not visible from the macro perspective. For example, in a medical education seminar, the selection of the speaker may be made by a medical education committee, with a purpose of fostering learning, or it may be made by a sponsoring pharmaceutical company which has an ultimate purpose, usually kept covert, of selling a product. These alternatives act as constraints at the micro-level, and may have unseen significance in relation to the possible learning outcomes of the seminar.

The Psychological Level Seen Only from a Social Level Perspective

In the complexity literature, even where a writer does acknowledge that complex systems have internal differentiation, there is the further, linked, issue of reductionism which can cause the *significance* of the system's internal distinctions to disappear. This occurs where, as in traditional sociological literature, some form of 'individual' and 'social' levels of functioning are recognized as differing, but where the individual level is conceptualised from a social level perspective only. The traditional social level perspective of the individual is the individual in the abstract: the objectified, generic individual; 'the man in the street' or the individual who is represented as a 'variable' or 'statistic' in social research. What is not seen from this perspective is the subjective individual engaged in inter-subjective relations. This is the uniquely contextualised, embodied, concretely experiencing and thinking individual as agent in interaction with other individuals. So, for example, the business organizational writer Ralph Stacey, who uses complexity to look at organizational functioning and who appears to understand complexity largely in deterministic terms, takes the view that 'human interaction is analogous to the *abstract* interaction modelled by complex adaptive systems' (Stacey, 2000), (italics added). This means that the individual can only be seen from the abstract social level view-point and the co-existing subjective individual is not seen. This leads Stacey to regard the distinction between the individual and the group as an unhelpful 'dualism/duality' (Stacey, 2003), claiming that 'the individual, the group, the organization, and the society are all the same kinds of phenomena, at the same ontological level' and 'The individual and the social …. simply refer to the degree in which the whole process is being examined. They are fractal processes' (Stacey, 2000). In other words, the only difference, as with fractals, is one of scale. This allows Stacey to argue that individuals and group/organizations are aspects of the one process which he calls 'interaction between people' (Stacey, 2003). While this is a valid perspective, it is a narrow one because it denies the distinction between the subjective individual and the individual as a social entity as belonging to separately functioning complex systems, psychological and social respectively, reducing the two to one ontological level. This limits the usefulness of complexity in considering the writer's subject matter, which is

how to conceptualise learning in, and learning by, organizations in which individuals function both as an individual and as an organizational member.

The Disappearance of Psychological Level Functioning

In my opinion it is problematic that a differentiation between a psychological level of functioning[6] and a social level of functioning is poorly addressed in much of the literature using complexity theory. Most writers leave out any consideration of psychological functioning altogether, linking biology to the social. Hence the presentation of accounts of levels in complex systems such as 'Human cognition involves neurons, minicolumns, macrocolumns, cortical areas, brain hemispheres, social groupings, communities and societies' (Davis and Sumara, 2005) where the authors move from 'brain hemispheres' to 'social groupings'. Or: 'As such, autopoietic theory could be seen to provide an understanding of *the biological causal processes from which observable social behaviour derives* (italics added)' (Goldspink and Kay, 2004). Some writers such as Stacey above, do address the issue, but in the form of a claim that there is no need for a differentiation between psychological and social. Accounts such as these either reflect a reduction of bio-psychological functioning to biology alone, or that that psychological functioning is understood as an epiphenomenon. This means that for these authors psychological functioning plays no part in the facilitation or constraint of the functioning of social structures.

Another view on the place of the psychological from a complexity perspective is illustrated by the philosopher of sociology Edgar Morin, who claims 'It is the brain-culture relation that produces as emergent psychic, mental qualities, with all that involves language, consciousness, etc.' (Morin, 2006). Morin's view, perhaps shared but not explicitly stated by the authors above, that in some way biological and social combine to give rise to the psychological, but how this comes about is not addressed. This comment illustrates the problem defined in traditional sociology as the 'micro-macro problem' that of how to understand the link between individuals and social phenomena (Goldspink and Kay, 2004). This is commonly expressed in terms of

[6] Here, psychological *functioning* is not conceptualised as entirely relating to the individual alone, but to the individual and/or co-present group, a conceptualisation that is to be elaborated on.

concerns about how socialization of the individual can come about, where the problem is to do with how social norms and values 'get into' the mind of the individual being socialized (Vanderstraeten, 2000b).

These differing ways in which psychological functioning, with its living, indeterminate complex relations, is left out of consideration, come about because, despite using complexity theory, these writers are working from a deterministic complexity perspective, which belongs within a substantialist framework. Here, psychological level functioning is subsumed into the relationally reduced, entity based understanding of either biological or social level functioning. My argument is that these writers then have to work with significant conceptual limitations. In not allowing psychological functioning equivalent ontological status as that attributed to biological or social functioning they have no access to the *subjective* individual for their theorizing. This means that in relation to constructs such as meaning, intention or agency which have subjective as well as social aspects, they are limited to the generalized account from reductive social-level perspectives. Again consistent with an entity-based perspective, to equate psychological functioning with biological functioning is to conceptualise psychological functioning as being co-terminal with the human individual. As will be made clear below and in the following chapter 'Complexity and the Psychological', one of the arguments of this thesis will be that some aspects of psychological functioning, specifically the processing of affect which underlies the creation of meaning, can be understood as a shared process that occurs between individuals, in the context of the co-present group.

Much learning takes place in social settings, such as classes, or uses social phenomena, such as bodies of knowledge, handbooks, plans, etc. At the same time, individuals clearly learn from personal experience and are able to use aspects of previous learning in new contexts. This suggests that learning is an area of inquiry where a differentiation between psychological functioning and social-level functioning, and a consideration of how the two may be related, is particularly relevant. I understand the inability to make this differentiation as one of the factors that contribute to the long-standing problem of whether learning should be conceptualised as an individual or as a group/social activity.

If it is accepted that learning has aspects of both then there are questions to consider about how they may be related. This problem underpins debates in organisation studies about whether organizations can 'learn' and if so, how does such learning come about and where is it 'located' (Stacey, 2003; Elkjaer, 2003; Paavola et al., 2004) and debates in the field of education about whether, or how, cognitive and sociocultural approaches to learning can be reconciled (Mason, 2007; Alexander, 2007).

Relational Reduction at the Micro Level of Complex Systems

In the complexity theory literature in the social sciences, there is a further way in which internal distinctions in complex social systems lose their functional capacity or 'disappear'. This is by relational reductionism of relations internal to the system where the relations which form the micro level of complex systems are usually considered as Deweyan inter-actions. This reduces the relations, in terms of functionality, to entities in contrast with complex, trans-actional relations. Understanding all relations in this way appears in the social sciences literature in the form of writers taking *entities,* in the form of individuals, as *being* the micro level of the system, much as they would be when considering a system conceptualised as a structure of things or entities rather than of relations. This means that the understanding that complexity has an irreducibly *relational* basis disappears. For example, in considering self-organization in the formation of social groups, Davis and Sumara write in the following terms: 'Individuals come together into flexible clusters, clusters come together into larger clusters, and so on' (Davis and Sumara, 2001). This is an account of a 'complicated' system rather than a complex system. In a complex system, the micro level of the system is not composed of entities that 'come together' in a summative way to make larger versions of the same thing. The micro level of a human or social *complex* system, wherever it is defined as being and whatever the entities involved may be, is more usefully understood as one of *complex relations,* and it is the functioning of these micro level, but complex, relations that can give rise to the emergence of something radically new, characterised by different internal relations, rather than a just a bigger, more complicated version of the initial phenomenon.

Distinctions Between Biological, Psychological and Social Modes of Functioning

From the field of inter-connectedness that makes up both the non-living natural world and the living world, the science that we are used to using already makes rough distinctions between inorganic (physical) and organic (living) material, and more directly in relation to human beings, between biological, psychological and social levels of functioning. In keeping with a relational realism idea that a living (psychological or social) complex system is indeterminate and neither presents itself fully defined *to* an observer nor is fully defined *by* the observer, it can be taken that these categorizations are not arbitrary, and that they reflect, albeit incompletely, some differentiation in functionality, and can be used for thinking about distinctions between 'levels' in complexity.

Biological, psychological and social aspects of human functioning are mutually dependent, but it is also useful to understand them as being distinct levels of functioning on the basis of each being characterised by irreducibly different micro level relations. They can then be conceptualised as individual but linked complex systems:

- the functioning of the body/brain as a socially influenced, (influence that is interpersonally mediated), but organic- or biologically- based complex system, of which consciousness or psychological functioning is an emergent feature;

- the interactions between individual members of a community, in multiple co-present groups, where affect is processed and where instances of inter-personal communication form the micro level of emergent social functioning, producing the meaning-bearing material for elaboration into social structures;

- social functioning, itself a complex system, from which increased internal complexity gives rise to emergent sub-systems, which are nested within the larger social system as a whole.

Here, each system has a micro level characterised by complex relations specific to that system and that level. The functioning of these relations produces the macro level of the

system while providing internal constraints on what is possible at the macro level of that specific system. Then, the macro levels can be seen, in turn, to constitute what functions as the micro level of another system, providing the working complex relations that will give rise to another macro level in turn. This schema is an abstraction from the complexity of human existence, made in order to focus on the relations between interdependent but discrete, autopoietically functioning rather than autonomous, levels of complex systems. An argument of this thesis is that these levels need to be addressed separately in order for the relationships between them to be considered.

What follows, in relation to social and psychological systems, is informed by this understanding of individual human experience and social life understood as separate but linked complex systems.

5.2 DISTINCTIONS AND MEANING

Distinctions

I want to review the way in which biological, psychological and social systems can be understood as differentiated but linked, self-referential or autopoietically functioning, complex systems in the work of Niklas Luhmann. Niklas Luhmann was a German sociologist who worked as a systems theorist and whose significant body of work is, for various reasons, only currently being translated into English (Becker and Seidl, 2007; Herting and Stein, 2007). The central tenet of his work is that social systems function self-referentially, their on-going self-directed internal functioning making and re-making the distinctions between themselves and their environment on which their existence depends. The basic elements of social systems, the 'stuff' of which they are made and out of which they reproduce themselves, are communications (Vanderstraeten, 2000a; Bechmann and Stehr, 2002; Seidl and Becker, 2006). Communication is a term which for Luhmann has a specific meaning. In Luhmann's terms communication is a relation that involves corresponding changes in two complex states, say, complex A and complex B, each of which has multiple possibilities for determining its own state. A *corresponding* change is brought about by each state making selections *in relation to the other*. Making selections involves accepting

limitations and this reduces complexity in the relational system (Luhmann, 1995:38-39). Luhmann's 'communication' is a communicative process and has a parallel with the process of Dewey's trans-actional relations being reduced in complexity to produce inter-actions, for the human purposes of practical use in inquiry or communication.

Luhmann did his later theorizing concurrently with the development of complexity theory and there are parallels between it and a complexity perspective. His focus is on the functioning of society as a whole and the social sub-systems derived from this whole, but this work is based on careful attention to the differentiating of micro from macro level functioning and a teasing out of what to consider as being the micro level components, or elements, of society, the workings of which produce macro level social functioning. His purpose is to understand 'how events that can be attributed to individual actors become meaningful within a process that, itself, cannot be attributed to individual actors' (Nassehi, 2005). It is an area of debate in sociological theorising as to what, of possibilities such as power, exchange or action, is to be considered as the element or basic unit of social reality and Luhmann is the first significant theoretician to nominate 'communication' as such an element (Stichweh, 2000; Vanderstraeten, 2001b). In taking communication as the basic element of social functioning, Luhmann is basing his theories in human interacting, and specifically those interactions that are involved in the production of meaning, thus making meaning central to his theories (to be elaborated on below). So I would argue that a significant aspect of Luhmann's work is that his basic element of social reality is not just relational (communication) but could also address the *function* of these relations, which is the processing and producing of meaning. The term function or functionality refers not just to the 'how' of an activity or process but also to the *purpose* of that activity, implicating meaning.

Luhmann's work is of significance for this thesis because his use of communication means that the functional micro level of this complex system is relational and the macro level, society, emerges from relations, not directly from individuals but from relations *between* individuals. This allows for a differentiation between the complex system that has the mind as an emergent level, and the complex system that has society and social systems as the emergent level. With this differentiation of psychological and social

functioning in social systems, Luhmann's work opens the way to understanding differentiation between individual and group or social aspects of learning.

Before looking further at Luhmann's understanding of the concept of communication and how he relates it to social systems, it is necessary to review some difficult conceptual areas that are central to his work. These are his use of the concept of autopoiesis, which he abstracts from its original biological meaning to use as a general feature of human and social functioning; and the concept of 'making a distinction', referred to above, which he takes as the central activity in human social processes. This leads into Luhmann's use of the concept of information from which he developed his theory of how communication, originating interpersonally, comes to form the network that bears social meaning.

Luhmann's Use of Autopoiesis

Autopoiesis, or self-reproduction, was introduced in Chapter 3 'Relations and Systems' and elaborated on in Chapter 4 'Complexity'. Autopoiesis as a theoretical construct was developed by Maturana and Varela based on experimental research in biology (Maturana and Varela, 1980). It refers to the functioning of biological systems, such as the cell, which are both open to taking in nutrients and excreting products, but closed in relation to their internal operations, making them self-referential systems. That is, they manage their own functioning without external direction and they relate to the environment on their own terms, attempting to control their own boundaries with the environment and managing what is allowed across the boundary and what is kept excluded. While the external environment cannot control their *functioning*, they are dependent on it for material supplies. They are also vulnerable to it: the environment can impinge on, intrude into, or kill, such systems. The construct of autopoiesis was proposed to address the question of 'What is life?' (Arnoldi, 2006). Living systems 'live' by recursive self-production. From their origins they contain the information they need to produce and reproduce, throughout their lifetime, the internal structures that they need to function. These include the structures that contain the information that

directs that reproduction. In this circular manner, the elements of the system can be described as functionally 'self-producing'.

While autopoiesis, as originally described refers to living organisms, in his work, Luhmann abstracts the concept from its biological origins in order to use it as a general principle for human systems, organic, psychological and social (Vanderstraeten, 2000a; Seidl and Becker, 2006). Luhmann understands biological, psychic (psychological) and social systems as forms of systems that can be differentiated on the basis of each having its own autopoietic functioning. He distinguishes between, on the one hand, organic, biological systems where life is an emergent feature of their functioning, and, on the other, psychic and social systems, where for both, the 'evolutionary level emergent feature' is 'meaning'. The only way to differentiate psychic and social as systems, is not on the basis of *what* is emergent (it is meaning), but on the basis of *how* it is produced (Luhmann 1995: 97-99), in other words, by looking at the *differences* of the micro level functioning of the system.

The micro level functioning of the psychic system is mediated biologically, by the body/brain, described by Luhmann as 'bodily connections'. He describes meaning being experienced in this way as 'consciousness'. In contrast, the micro level complex relations that give rise to social meaning are *between* individuals, where meaning appears 'in relation to the consciousness of others' (Luhmann, 1995: 98). For meaning that has this mode of generation, he uses the term communication. Consciousness has an organic or biological substrate in the form of the body/brain, and the relations of consciousness are (largely) internal to the individual. Communication, however, is external to any individual body/mind. Its micro level relations are not internal and mediated biologically but in contrast are the more abstracted and reduced relations of the interactive processes *between* individuals (Vanderstraeten, 2000a). A consequence of Luhmann's re-conceptualisation of social systems is that while psychic and social systems have co-evolved as meaning-processing systems, and they are mutually dependent in that neither could exist without the other, at the same time they are radically distinguished from each other, because they do not share the same autopoietic function (Stichweh, 2000).

Before looking further at what Luhmann's claim that social and psychological systems function autopoietically means in terms of the differences between them and how they relate to each other, it is necessary to expand on what he means by his use of the term 'communication'. To do this means returning to the concept of distinction but to a more formal understanding of the concept.

Distinctions

The first move in making a communication or beginning any form of inquiry is making an observation. In making even a first observation, such as naming something, the complexity of what is to be dealt with is reduced. Making such an observation creates a system which is composed of three entities: the namer, what is named and what is left unnamed. It is a system of which the observer is a part; an observer-phenomenon system, where both the observer and the phenomenon being observed are based in indeterminacy (Baecker, 2001). For any phenomenon that is to be observed, there are different ways of making a distinction that will be the beginning of the observation, but when made, the observation is 'blind' to the whole of the range of alternative possibilities that could have been made, but were not. This commonly leads the observer to attribute the observation to a quality of the phenomenon itself, rather than to the act of making the distinction (Seidl and Becker, 2006). For example, 'this computer works slowly' rather than 'I experience this computer as working slowly'. This illustrates how a representational view of reality might come to be experienced, as it commonly is, as 'commonsense'.

Luhmann uses the concept of distinction in George Spencer-Brown's 'laws of form' or 'calculus of indications' to underpin his own account of communication (Luhmann, 2006). Spencer-Brown's calculus is a highly abstract, formalized account of the significance of making an observation, whether by a mechanical or a living system. For Spencer-Brown, making an observation involves first drawing a distinction. On one side of the distinction is what is indicated, called the 'marked' state and on the other, the 'unmarked' and indeterminate, state. All three components: the marked state, the unmarked state and the distinction, together make up what Spencer-Brown called 'the

form of the distinction'. Thus observing something involves making one move that has two aspects to it. The move is both making a *distinction* and simultaneously *indicating* which side of the distinction is chosen (marked). To name something is to make a *distinction* between it and everything else and also to *indicate* that the thing named is selected for attention; the possibilities on the other side of the distinction are the 'not selected'. Distinction and indication are intertwined and together make up the observation. Making such a selection, is a creative manoeuvre which provides the system with information in the form of 'this but not that', whereby something is included while something else which is contingent (also possible) but not chosen, is excluded (Spencer-Brown, 1971; Baecker, 2001; Vanderstraeten 2001a; Seidl, 2007). For example, recognizing a face involves making a distinction between the face that is seen and an indeterminate number of alternative faces (making a distinction) *and* at the same time seeing that it is that particular, known person's face (making an indication).

In making a distinction, two aspects are left indeterminate: the unmarked state and the distinction itself. The observer does not see what this particular distinction has excluded and does not see either the distinction he has made or what other distinctions could have been made (Seidl and Becker, 2006). He is 'uncritical of his own reference' (Vanderstraeten, 2001a). In order to 'see' the distinction, an observation of the first observation needs to be made, known as a second order observation. Thus to understand the *meaning* of the first distinction it is necessary to observe the system making it and to see both sides of the initial distinction and the distinction itself. This concept of 'observing the observer' or rather, 'observing the observation' is derived from second-order cybernetics. It can also be seen as an observation of a relationship: that which is between the two entities 'created' by the distinction, the selected state and the indeterminate state of unselected possibilities. It is an observation of the choosing, rather than the first-order observation of the choice (Seidl, 2007). That is, it is an observation of a *relation*, 'the choosing', rather than of an *entity*, 'the choice'. This observation of a relation rather than an entity introduces meaning. It does this because in observing the selecting relation, what is not selected can also be seen. The selection is given a context and hence meaning. (This will be elaborated on below.)

Information and Communication

The traditional view of communication is that it is a one-sided announcement, or 'broadcast' of material carrying already determined meaning. The mechanism is that someone makes an utterance that contains a definitive meaning, which is received by another person, who may or may not correctly understand the intended meaning. This account can be seen as coming from a substantialist perspective where, in a sense, meaning is passed between people, as if it were an abstract object or entity. Luhmann describes this as a metaphor of 'transmission' which is unsuitable for understanding communication. He argues that this traditional view belongs to a 'thing metaphoric' (a substantialist perspective) which implies that information is an object and that it exaggerates the role both of the sender, who appears to control the meaning of the communication and of the communication itself which appears to have one meaning for both the sender and the receiver, whose only choice is to be right or wrong in understanding it (Luhmann, 1995: 139-140). Luhmann's view is that communication is not as understood traditionally, but is a socially relational activity which involves three parties: sender, receiver and the information that relates them (Stichweh, 2000). He proposes an internal structure for the communication that is comprised of three parts which he names as: information, utterance and understanding (Luhmann, 1995: 139-171; Stichweh, 2000).

In relation to information Luhmann uses Shannon and Weaver's 1949 definition of information. This is that information is a selection from a set of possible alternatives. For Shannon and Weaver the set of possible alternatives was limited or determined by technical constraints. So, for example, the information carried by the figure 'C' is constrained by whether it belongs to a set of letters, 'A B C..', or a set of Roman numerals, where it would mean '100'. This means that we do not understand a message by its content alone but by looking at it in context as a selection from available possibilities, that is, looking at both the selected and possible but not-selected. In social communication the set of possibilities is socially constrained rather than technically constrained as in the work of Shannon and Weaver (Baecker, 2001). Social constraint is already present in communication as the communication event has a context: it refers to

preceding communications between the participants; the participants may know something about each other that will influence selections made and further, the communication itself has social meaning as it has connections with other communications in the social field.

The three parts of Luhmann's communicative act are all selections. The sender selects information from possible alternatives. In making an utterance he makes a second selection involving 'the form of and reason for a communication: *how* and *why* something has been said' (Seidl and Becker, 2006). The utterance reflects his intended meaning in making the selection of information made. Finally, the receiver also makes a selection which Luhmann describes as making a distinction between information and utterance (Luhmann, 1995: 145-6). This can be understood as the receiver choosing from possible interpretations of what is presented to him, by observing the sender's selections. That is, the receiver makes an observation of the selection and indication made by the sender. The meaning of the communication is only realized after the last selection is made, so what is communicated is not determined by the intended meaning, but by the understood meaning, which has been arrived at by the process of selections. The meaning of communications is something that is only constituted during the communication process by a 'coordinated selectivity' (Luhmann, 1995: 143,154; Vanderstraeten, 2000b; Seidl and Becker, 2006). The receiver's response may then lead to further communications and thus contribute to the network of communications that Luhmann sees as forming the basis of social systems. The communicative act described this way can be seen as two parties reducing complexity by alternately making reductive selections until the communication ends, either because an agreed meaning is reached or the communication fails or is broken off.

Luhmann describes communication as being made 'contrary to the temporal course of the process' (Luhmann, 1995:143). I understand this as a reference to his claim that the meaning of the communication is not produced at the beginning of the interaction, as in the broadcast model, but emerges at the end of the process. Communication has been described as being bidirectional: read forwards sequentially in time but read backwards in relation to discovery of meaning: 'a communication only begins with the second

participant who *understands* and in the act of understanding projects the difference between *information* and *utterance* on the first participant' (Stichweh, 2000). This can be understood as a cybernetic second order observation, the *understanding* of a first order relationship, that between *information* and *utterance*. I think that the reference to working 'backwards', means that Luhmann's communication should be understood not as a process that is linear in time, backwards or forwards, but as a complex system in which time is an essential dimension. Much as Dewey conceived of the reflex arc as being not a linearly causal 'stimulus followed by response' but as a stimulus-response system of which different phases (stimulus, response) appear differentially in time, so with Luhmann's communications, the meaning is contained in the process as a complex whole and emerges only in time.

Unlike the relative stability of biological or biologically-based systems such as the human mind, a stability which is based in their materiality, social systems are composed of communications which individually are fleeting, disappearing as soon as they have appeared. However, communications do not stand alone (Seidl and Becker, 2006). Their meaning is defined by and linked with other communications. It is this 'connectivity of communications, occurring in time', the producing, linking, reproducing or neglecting of communications in the processing of meaning that is the mode of functioning of social systems (Nassehi, 2005). This processing work is done of course, not by the communications themselves, but by the use of communications as tools by interacting human minds. This use involves the interpreting and re-interpreting, modifying, expanding, further reducing or elaborating of communications linking them with bodies of social meaning. An example is a community of practice, using theories that it has produced for use as tools by community members. This use drives the evolving nature of such theories, not in pursuit of some fundamental 'correctness' but as a result of the community's efforts to manage continually changing environmental contingencies.

5.3 CO-RELATED CONCEPTS AND CONCEPTUAL ARTEFACTS

Before considering Luhmann's account of the social systems which emerge from the process of communication production, I wish to discuss something of the work of two

writers which contributes to an understanding of the various fates of these social level phenomena that are products of human interacting, which Luhmann calls 'communications'. One is the philosopher Jeff Malpas' account of the concept of the 'co-related concept'. Concepts are elaborated products of social communications but are fully abstract and retain some of the indeterminacy of their complex relational origins. This is seen most clearly in those pairs of concepts, for example, context and meaning, called 'co-related concepts' by Malpas, where each concept is needed to define the other. The second theorist is the educational psychologist Carl Bereiter, whose concept of 'conceptual artefact', such as a plan or a guideline, illustrates the capacity of concepts to function as tools, highlighting the social origin of concepts.

Conceptual Complex Systems: Concepts and Meaning

The first thing to note in considering concepts as meaning bearing social phenomena is that concepts themselves are indeterminate. The term concept is derived from the Latin concipere, 'to conceive', which itself is derived from *con*, 'together' and *capere*, 'to take' (Chambers Dictionary, 1983).The concept of 'conception' as being something 'taken together' suggests that the concept has a relational basis.

Malpas, in a paper on the concepts of 'context' and 'meaning', illustrates how concepts in general resist the determinism that would allow them to be defined in a clear-cut way. He takes the concept of 'context', to show that definitions of context rely on the *specifics* of the particular context at hand. A *general* definition of context is not possible. Even where context is a central and essential concept in an area of theory (his examples are the fields of hermeneutics and pragmatics within language studies), attempts to define it as a general concept commonly fall back on terminology that already contains some prior understanding of contextuality, such as references to 'background' or 'relevant aspects of setting'. This leads to a circularity that makes the definition of context, as a determinate individual entity, impossible (Malpas, 2002).

However, Malpas argues, the presence of context gives 'a meaningful presentation' to an object, word, event, or person, and it is 'the relation between presented object and presentational setting' that gives meaning to that object. Because meaning depends on

the relationship between the two it may be lost or changed if object and context are separated. Together they make 'a relational or holistic structure'. Concepts which have close links with certain other concepts, Malpas calls 'co-relative concepts'. The examples here are 'presentational object' and 'context of presentation'. (These may be two literal entities, but they have a *conceptual* functionality in relation with each other.)

What has been experienced in the pursuit of determinism as a circularity of concepts (above) can be understood as a trans-actional relationship involving *co-relative* concepts. Individually, as with 'presentational object' and 'context of presentation', neither of the co-relative concepts can be fully formulated. However, each 'implicates' the other and can be used to illuminate aspects of the meaning of the other. It is necessary to use the relations that a concept under consideration has with other co-related concepts in order to understand it, including knowing what its 'legitimate boundaries of use' are. Elaboration of a concept 'is seldom a matter of reduction, but almost always of conceptual relation' which produces a web or a relational structure, so that defining a concept becomes more a matter of describing its place in a network of concepts, by its relations with other concepts, than producing a determinate definition (Malpas, 2002).

Although he makes no reference to complexity concepts, Malpas can be seen to be describing concepts as functions, rather than entities, and understanding them as parties to complex relations forming a 'holistic structure', or complex system. Complex systems are structured by relations and the system is not inherently separated from its environment. So in order to be able to discuss his selected concepts, Malpas draws a boundary, his 'legitimate boundary of use', for them. This creates or selects out the concepts that will be the object of his inquiry. He points out the impossibility of handling concepts as if they are entities that can stand alone, fully determined. Instead he addresses concepts as part of a complex system where co-relative concepts have a complex relationship with each other.

Further, although again Malpas does not spell this out, it is a relation that is productive or generative. It is from the complex trans-actions between co-related concepts that the

meaning of both emerges. He phrases the production of meaning in relation to context as 'the presence of context *giving* a meaningful presentation to an object (italics added)'. This is true, and so is the converse. With a shift of focus from the entities of 'context' and 'object', to the relations between them, his claim can be understood as a reference to the way in which the co-related concepts of 'presentational object' and 'context of presentation' are functional parties to a trans-actional relationship from which meaning emerges. This is meaning that is situated and specific to the relationship from which it emerges and is meaning of both object and context in relation to each other.

Meaning itself, as with the concept of context, 'is a function of the relating of elements rather than being already intrinsic to any single such element' (Malpas, 2002). Relations of any sort do not inherently contain meaning but meaning emerges from the processes of relations. It is possible to go further and claim that trans-actional relations are models of the form of relation implicated in generativity, including the creation of meaning: that it is the functioning of trans-actional relations from which meaning emerges. Deterministic relations can be regarded, like concepts, theories and plans, as abstract social artefacts that can function usefully as tools. They can be used to manipulate and elaborate information but as with any other tool they cannot, themselves, function generatively to produce meaning.

Conceptual Artefacts: Concepts and Materiality

The term 'conceptual artefact' is useful for considering another perspective on how meaning functions in the social domain. It was introduced by Carl Bereiter, using Karl Popper's differentiating between the 'physical world, the subjective or mental world, and the world of ideas', to address the role of this latter form of knowledge. Bereiter differentiates between 'knowledge used in productive work and the knowledge that is the object of such work' (Bereiter, 2002: 62-92). The former is the 'know-how' of work, skills or social practices or knowledge as processes which involves individual or group minds. The latter, 'the knowledge that is the object of such work', are the coherent bodies of knowledge composed of linked ideas, concepts, theories, designs and

plans that have a social function. He uses the term 'conceptual artefact' for these bodies of knowledge, because while they are immaterial, they are human constructions as material artefacts are, and like material artefacts they are experienced as external to the individual, having an 'out-in-the-world-existence' (Bereiter, 2002: 465-483).

Conceptual artefacts are a social level phenomenon. Bereiter defines them as having three fundamental characteristics in being 'discussable, modifiable and autonomous', the most significant feature being their autonomy (Bereiter, 2002: 482). Some may have close connections with material artefacts, such as the designs or plans that are representations of material goods, but they are treated in a separate manner to the way that material goods are, as abstract objects or entities in their own right. Equally, conceptual artefacts are not contained in individual minds; they are experienced as external to the individual. I would understand their quality of 'autonomy', not as a quality inherent to the entity of the conceptual artefact as Bereiter appears to do, but as a quality of the human *relation* to the entity, the *experience* of which is of something as being external to the mind and therefore autonomous.

Bereiter sees conceptual artefacts as entities that are produced, worked on and can be tested out and 'improved on' by being the focus of deliberate discourse. This improvement he calls 'knowledge building' (Bereiter, 2002: 62-92). Bereiter differentiates knowledge building from individual learning on the basis of the aim of each as an activity. He understands individual learning to accompany everything that we do, including knowledge building, but its relationship to knowledge building is that of epiphenomenon. His understanding of individual learning is as a primarily separate activity, directed by the individual at 'changing the state of (his or her) mind to achieve a gain in personal knowledge or competence' (Bereiter, 2002: 254-255).

My conceptualisation differs here from Bereiter's in that I do not think that it is possible to use conscious intention to differentiate learning by the individual, and production or 'improvement' of knowledge which can be used socially. I understand them as aspects of the one process, differentiated on the basis that the one process involves two forms of

complex system, the individual mind[7] and social system functioning respectively. Bereiter's 'knowledge building' is a process that is based in human affective needs, such as, say, the wish to improve a conceptual tool for solving a problem. In this one process, the individual will learn through the experience of the process, *and* the conceptual artefact will be produced or 'improved'. The difference between individual learning and 'knowledge building' does not lie in the conscious intention of an individual or group but in the difference of learning as a process of the mind or minds and 'knowledge building' as a social level function.

From a complexity perspective, I think that what is important in Bereiter's work is the recognition, in his construct of conceptual artefact, of a form or aspect of knowledge that functions at the social level. It can be differentiated from knowledge as the subjective experience of knowing which is 'held' in the mind. A conceptual artefact is experienced by the individual as being independent of the self, having something of a life of its own in that it is produced by, and changed by, the discourse of a group, community or population rather than by the individual. Even where an individual works alone with a conceptual artefact he or she is functioning as a member of a group or community and the meaning of the individual's work is based on that of the group or community.

Bereiter works within a substantialist perspective. This is illustrated by his differentiation of 'the knowledge used in productive work and the knowledge that is the object of such work' and by his separation of learning by the individual from the process of 'knowledge building'. His few references to complexity (in the form of self-organisation) indicate that he understands complexity as deterministic and therefore relations as deterministic relations (see Bereiter, 2002:199-204). He limits his definition of conceptual artefact by differentiating between conceptual artefacts and what he calls as 'cultural artefacts', which are entities such as myths, literary works, and musical compositions. He defines conceptual artefacts as differing from these because conceptual artefacts can be recognised by the *logical relations* that exist between them

[7] The mind is a complex construct. Although subjectively, 'the mind' is experienced as co-terminal with the body, I will argue later that some aspects of psychological functioning are shared within the co-present group.

(my italics). Using a general complexity perspective it can be argued that it is the reduced, logical relations characterising Bereiter's conceptual artefacts that give these phenomena their entity-like 'feel' and their capacity to be readily defined as tools. What Bereiter is calling cultural artefacts feel more 'live' than conceptual artefacts because they are more resistant to relational reduction. Both forms of artefact depend for existence on being repeatedly reproduced by human usage and interpretation, which involves the *complex relations* of human minds, but it is more obvious with cultural rather than with conceptual artefacts. In comparison with a body of theory or a practice guideline, a myth is more fleeting, without material expression and more obviously depends for its existence on being re-told. As with a musical performance, each re-telling and performance differs subtly from any other. However, the differentiation between conceptual and cultural artefacts that Bereiter makes on the basis of relations, linking conceptual artefacts to 'logical relations', appears unnecessary. I do not think that the differentiation needs to be a categorical one because both conceptual and cultural artefacts *function* as carriers of social meaning. Both depend for their existence on community usage where they are produced, modified, developed, or discarded etc. on the basis of their function in human social interaction.

5.4 LUHMANN'S SOCIAL SYSTEMS: 'SOCIETY', 'ORGANIZATIONS' AND 'INTERACTION'

Luhmann describes three categories of social system, differentiated on the basis of functionality. One is the totality of social systems known as 'society'. Society is composed of all communication and it is the one social system without an external social environment of its own as it encompasses all social systems. It has sub-systems that have differentiated out of it, based on functional differentiation, which are the institutions such as law, politics and education etc. called by Luhmann, 'function systems'. In turn, there are 'organizations', which are derived from function systems and finally the interpersonal social systems that are based on face-to-face contact or 'co-presence', that he calls 'interactions' and which are the site of the communications which constitute 'society' (Luhmann, 1996: 405-436). All differ from the individual

'psyche' which is based not in inter-personal functioning but in culturally influenced bio-psychological functioning.

Complex systems operate by making distinctions. Luhmann's social systems can be differentiated on the basis of the form of distinctions that each makes. Society and its function systems process communications, organizations are characterised by a specific type of communication related to the making of decisions and 'interactions' function by what Luhmann describes as 'the processing of contingency on the basis of presence' (Luhmann, 1995: 430; Seidl, 2005).

Society and Its Sub-Systems

Luhmann's understanding of society is that it emerges from multiple, fleeting communications between individuals, over time. It is continually produced and reproduced by communications and all communications come into the 'pool' which forms society's substrate. He does not differentiate societies geographically but rather sees the world society as a coherent, evolving structure. Over time society has become increasingly complex and it makes internal distinctions, on functional grounds, to reduce complexity. This allows the emergence of the internal sub-systems which make up the major social institutions, such as political, health, economic, legal, educational, religious systems. Luhmann claims this *functional* differentiation as the defining characteristic of modern society. Each sub-system, or 'function system' in Luhmann's terminology, has emerged from society as a whole, to facilitate the work of processing distinctions around a primary distinction relevant to the respective function system such as power/no power, health/ill health, payment/non-payment, legal/illegal, truth/non-truth, etc. These sub-systems are not temporally prior to world society, but emerge from within it, from a particular social context, and they follow a trajectory that is actively shaped by local constraints internal and external to the sub-system. They have greater complexity in relation to their primary distinctions, power/no power etc. than does society as a whole. Society functions autopoietically, as a closed system without any overarching control mechanism. Society's sub-systems also function autopoietically, each concerned only with its continued reproduction and therefore its 'survival'.

Another way of putting this is that each subsystem has its own attractor, for example, for the institution of health systems the attractor would be the processing of the health/ill health relation. For a complex social system, an attractor constrains functioning, limiting it to the indeterminate variations of the meaning of the attractor. Subsystems relate to each other ecologically, each acting as part of the environment for other social sub-systems, while in pursuit of their own ends (Baecker, 2001; Vanderstraeten, 2001a; 2004; 2005; Seidl and Becker, 2006).

This is the origin of the example referred to in Chapter 4 'Complexity', of a treasurer (political system) having little success in directing banks (economic system) in their management of mortgage interest rates by making a public request. This is because the economic system has no mechanism for responding. Its autopoiesis prevents it from 'hearing' such a request, because political system concerns are not within its autopoietic functioning (its attractor). The treasurer does have the option of legislating (legal system) for change in the economic system, because the political system can use the legal system for that purpose, a point at which the autopoietic functioning of political and legal systems overlap. The economic system would then have to make an internal adaptation to this impingement from the legal system, in the form of bank compliance with legal constraints.

Organizations

Each of the function systems described above has a range of organizations associated with it. The law has legal systems, law-courts and police; the economy has financial institutions, the stock market and companies; politics has parliaments, local councils, and so on. Luhmann describes an organization as a social system with decision-making, or communications about decisions, as its central mode of operation, so organizations' functioning can be described as the processing of decisions. Organizations use their autopoietically-based decision making in the form of their procedures and regulations, to give themselves coherence and some purchase in the social world. Luhmann's account reveals the contingency and vulnerability of organizations whose 'life' depends on the continuity of producing and linking of decisions and whose structure rests only

on past decisions. Because 'the only basis of a system's operation is the system itself', organizations have to cope with the 'permanently menacing problem of self-deconstruction' by using decisions to introduce some semblance of certainty (Nassehi, 2005). Decision-making in a system such as an organization both reduces complexity in one area and produces it in another. It reduces complexity for the organization by 'absorbing uncertainty', because, once made, a decision offers a settled point which can be referred to in the future and the uncertainty that was present prior to the decision being made is hidden from view (Seidl and Becker, 2006). At the same time, decision-making as a this-and-not-that move, introduces new distinctions and therefore increases complexity elsewhere in the system.

Interaction Systems

In his classification of kinds of system, Luhmann separates the individual psyche from all forms of social system, and thus separates psyche, which belongs to the individual, from the smallest social system which he calls 'interaction'. Luhmann's 'interaction' systems are based on groups of individuals in what is commonly described as 'face-to-face' contact or co-presence, which is defined not in terms of who is literally present but functionally, in terms of 'who is to be treated as present and who is not'. Thus at a business lunch, the waiter, although physically present does not belong to the interaction system, while the absent businessman who sent apologies, does. A feature of 'interaction' systems is that they involve 'interpenetration', a term of Luhmann's referring to a relationship between systems that form the environment for each other. Here Luhmann is using the term 'environment', not in the sense of environment as everything outside an entity, but as environment for a particular complex system, as human individuals provide an environment for other human individuals. Interpenetration involves such systems making their complexity available to each other, in the service of building another system. What is made available is 'an incomprehensible complexity – that is, disorder for the receiving system' (Luhmann, 1995: 213-218). It is from the co-present group's processing of this shared disorder that 'interaction' systems produce the communications. While the totality of communications belong to society as a whole and function as the 'playing chips for

societal evolution', the workings of the co-present group itself, like the workings of the individual psyche, remain functionally excluded from society as a whole (Luhmann, 1995: 405-426).

While interaction systems produce communications, Luhmann also acknowledges that in intimate relations between individuals who know each other, the 'interaction' system 'exceeds the possibility of communication' referring not just to the limits of language and the meaning of bodily contact, but the inclusion of what is incommunicable, including 'the experience of incommunicability' Here, 'the principle of communication: the difference between information and utterance' does not occur (Luhmann, 1995: 228). I understand this as a reference by Luhmann to the non-verbal and non-conscious processing of affect than occurs in co-present groups, on which I will elaborate below and in later chapters.

The Psyche

In co-present groups, each 'communication' event between individuals is paralleled by events in the participating psychic system/s (Seidl and Becker, 2006). During the production of communications individuals will concurrently have a subjective experience of the interaction and personal thoughts about its meaning but these, by Luhmann's definition, happen within individual consciousness and so are outside the communication itself. The individual's thoughts may be conveyed by utterance (with non-verbal aspects) and then may contribute to the creation of communications. But communications arising out of social interaction are linked with each other, and cannot be created by sole individuals. So, for the individual, the only way to influence communications is by contributing to their production through participation in social relationships.

I will argue in the following chapter of this thesis that the aspect of interaction between individuals that Luhmann refers to as 'exceeding communication', that which is *not* his 'communication', while indeterminate, can be considered using current psychoanalytic thinking, specifically from the field of theories including British Object Relations Theory, the thinking of psychoanalyst Wilfred Bion and post-Bion theorists.

Psychoanalytic theory takes the perspective that while the individual's organic, or physiological functioning is bounded by the individual's body, aspects of psychological functioning, while experienced subjectively as co-terminal with the body, can also be seen to be shared with other individuals. These others are those who are in close personal relationship or who are, even if only temporarily, in direct face-to-face communication which has a component of real time affective (emotional) interaction. I will not elaborate further on Luhmann's concept of the interpersonal 'interaction' system. However, it is possible at this point, to see that unlike most other theorists who write from a sociological perspective, Luhmann acknowledges that, while there are social systems, such as society and its function systems, where what is *individually* meaningful is not relevant, there is also a system, his 'interaction system', where it is of prime significance. This has the effect of making a place for the individual as *specific* individual and the living relations between individuals in his sociology in comparison with traditional sociological perspectives where the individual is only understood as a *generic* abstract entity and relations are reduced to Newtonian relations.

5.5 INTERACTION OF THE INDIVIDUAL AND SOCIAL SYSTEMS

Luhmann's Conceptualisation of Autopoiesis

Luhmann differentiates biological systems, such as the nervous system, which processes life, from the psyche and social systems which are 'constituted by the production and processing of meaning'. Here he introduces his adaptation of Maturana's biologically-based concept of autopoiesis using the concept of 'observing the observation' of second order cybernetics, which I have described as 'observing a relationship' (above). Luhmann argues that, unlike biological systems, both psyche and social systems are systems with a capacity for self-observation. They can observe their boundary and environment relations, internalising the meaning of these observed distinctions and therefore being able to operate with them internally (Luhmann, 1995: 36-38). This use of the concept of autopoiesis is controversial. As with use of the concepts of deterministic complexity, there is debate about whether, or how, concepts developed in one field, which for autopoiesis is that of biology, can be used in another, sociology

(Mingers, 2002; King and Thornhill, 2003; Goldspink and Kay, 2004; Brocklesby and Mingers, 2005).

Psyche and social systems are irreducibly differentiated from each other. Luhmann conceptualises both systems as being constituted by an operationally closed self-reproduction by their elements, thoughts and communications respectively. But, individuals and social systems are also mutually dependent. In the same way that organic structures depend on an on-going supply of oxygen or nutrients from their environment, the social system's existence depends on individuals interacting for the production of a continuous supply of communications. Conversely, the individual psyche requires what Luhmann describes as 'difference and limitation', accessible only through engagement with its environment (Luhmann, 1995: 262-267). That the individual depends on having experience within social systems to have a life that is recognizably human is illustrated by the, to our eyes, grossly impoverished and 'un-human' experience of life of feral children or so-called 'wolf-children' who have been deprived of human interaction at critical developmental periods (Maclean, 1979).

Autopoietic functioning produces systems that function by making distinctions between the system and its environment. The differentiation between psyche and social systems is a result of each system's autopoietic closure to the other. This mutual autopoietic closure means that each system relates to the other as part of its environment. The two systems cannot relate directly; each system can only make contact with the other on the basis of its own internal operations, that is, where it is able to make adaptive internal changes determined to be in its own interests which match with the other system's interests. This means that social systems act as environment for individuals and, although it sounds counter-intuitive, individuals are excluded from social systems and they form part of the environment of social systems (Vanderstraeten, 2000a; Nassehi, 2005; Seidl and Becker, 2006).

The individual experiences himself or herself and others as subjective beings, but from the perspective of a social system the functioning of the individual is as a generic entity. Examples of how individuals can experience this can be seen in the private experiences

of individuals relating to institutions or organizations, where the individual may feel dehumanised in those interactions. Hence, articles and television programs anthropomorphising organizations as 'psychopathic' when individuals find the experience of being treated as a generic individual painful. Or the lay response to language used in an organisational context as being 'jargon' as it is incomprehensible to those individuals who are excluded from that organisation's functioning. Or in the experience of exclusion felt by a patient who is distressed to read about himself in a doctor's letter. Here, the communication is not intended as a communication *with* him, but as a communication *about* him, a communication which belongs to the medical system in which he is limited to the reductive role of, say, patient with illness x. This exclusion of the individual from social systems can also be seen in the way in which an *individual* cannot control a social system. As described above, he or she can influence a system by participating in relations internal to the system, but only contribute influence, not control. So, a government minister, as an individual, has only a limited degree of control over the functioning of his portfolio and managers of organisations probably have less influence in bringing about organizational change, for good or bad, than is commonly claimed by, or attributed to them (Falconer, 2002; Luhmann, 2006).

This distinction between individual and social system is what underpins Luhmann's radical claim that society is *not* composed of individuals, but of the communication that they produce relationally, in the process of interacting. Luhmann describes the individual's place in the social world as that of being part of society's environment. What he means here is that in conceptualising society as a complex system that functions autopoietically, individuals have the same kind of relation to society that molecules do to the cell. The cell's on-going self-reproduction depends on the availability of necessary molecules in its environment. However these molecules, or rather molecular activity, function as raw material to be used by the cell. It has no part in the mechanism of the cell's operations. Further, the cell does not need any specific, individual molecules for this role but only a specific *type* of molecule, one that will function in the standardised way the cell needs. This standardisation means that any one molecule of the type will do. In a similar way the continuation of society depends on the

availability of individuals to produce communications, but from a societal perspective, individuals function only to engage in communications, producing the raw materials for society. As such they have no direct capacity to affect societies' functioning. Again, as with the cell's relation to molecules, who the specific individuals are, and the content of their communications are not relevant in the sense of what meaning they have. For society, communications have the same functional significance irrespective of content; Society as a whole has no over-arching purpose or intent. Function systems and organisations however, do have purposes which thus constrain the content of communications available to them.

In Luhmann's theories, the exclusion of the individual, as an individual autopoietic system, from being an integral part of social systems, means that individuals are accorded greater freedom than social systems have (Vanderstraeten, 2000b). Social systems have gained some stability at the cost of reduced complexity and an individual taking a social role within a system is constrained by the system in which they are functioning. That the subjective individual has greater freedom than that allowed by such a role is illustrated by the way in which that individual would feel significantly limited if he or she had to 'be' their social role, *had* to adopt, even privately, the espoused social values of the role, or could think and act only in keeping with the social norms associated with it. As an individual distinct from social systems, he or she is free, within limits, to interpret a social role as s/he judges to be appropriate and to have and express individual opinions within personal relationships. In terms of complexity, individuals (and co-present groups by virtue of shared autopoietic functioning) have a greater complexity than larger social systems. Larger social systems have their origins not in complex biological systems but in the necessarily reductive social communication arising between individuals, and while a system's functioning depends on the constant interpretation and re-interpretation of its functional meaning by individuals in interaction, these interactions are constrained by the meaning or 'purpose' of the system. That social systems (other than co-present groups), have achieved their degree of structural stability through a reduction of complexity, means that such systems, taken as a whole, are less 'intelligent' than co-present groups, making them systems where

'the whole is *less* that the sum of the parts' (Baecker, 2001). This view differs markedly from that of some writers (Stacey, 2000; Hodgson, 2006) who equate the adoption by individuals of abstract social roles with an increase in individual functional capacity and who thus see an organization as having a greater functional capacity or 'intelligence' than co-present groups. This perspective has significance for forms of learning. I will later argue that small groups of individuals working together in a co-present group have a greater internal complexity and therefore 'intelligence' than the organisations or institution within which they may be functioning.

5.6 CONCLUSION

Luhmann's theory of social systems gives an account of such systems that is consistent with a general complexity perspective. Central to his theorising is his understanding of social phenomena in terms of functionality rather than substance and his concept of distinction processing as the mode of that functionality. Of specific relevance to this thesis is his model of communication as a complexity-reducing process that creates meaning.

Reductionism is a mechanism for managing the indeterminacy of the complex real world by disposing of complexity in order to be able to make a positivist presentation of the object of inquiry. In contrast, Luhmann's ontological framework, within which systems make or process distinctions to manage complexity, is one where indeterminacy is acknowledged, accommodated, borne and used. Indeterminacy is a partner to anything determined: knowing can only occur accompanied by the limit of not knowing.

A consequence of Luhmann's use of the concept of distinction processing is that a differentiation between psychic (psychological) and social functioning is revealed. His account of communication lies in his argument that the three selections (information, utterance and understanding) form a unity that cannot be reductively decomposed into its constitutive elements (Stichweh, 2000). Because a communication necessarily involves two or more individuals, then by definition, it cannot belong to, or be contained in, any one individual mind. Communications are socially based co-constructions of two or more individuals. Alternatively they can be described as an

emergent property of the interaction between two or more psychic systems (Seidl and Becker, 2006) and as an emergent property, cannot be reduced to the system that produced them. Or they can be understood as information about a relationship that cannot be stored in any one individual mind (Artigiani, 1998). Thus Luhmann's account of communication as a mechanism by which meaning is produced is of a mechanism that is irreducibly social.

Luhmann's theories relate to social systems and his focus of interest is in their production and their relations with the individual and with each other. In the next chapter I will look at the significance of considering distinctions in relation to the human individual: body/mind /other distinctions and the functional systems that this reveals: the 'shared' psychological functioning of the co-present group for processing of affect and what can be thought of as the socially constrained bio/ psychological functioning of the individual mind.

CHAPTER 6 - COMPLEXITY AND THE PSYCHOLOGICAL

INTRODUCTION

In the previous chapter, I outlined how Luhmann understands psychological function and social function as complex systems that are differentiated from, but linked to, each other, a differentiation of 'what belongs to society and what has to be allocated to humanity' (Bechmann and Stehr, 2002). This differentiation allows a double perspective: a social perspective on the individual and on social phenomena and the individual experience of the self and other individuals and of social phenomena. This differentiation is necessary in order to be able to look at the varying formulations of relations between the social and the individual; when the differentiation disappears the scope of inquiry is correspondingly narrowed. It is a perspective of the embodied, affectively based and relational functioning of the individual mind that will be the focus of this chapter.

In this chapter I will address:

6.1 The differentiation, following Luhmann, of psychological functioning from social functioning on the basis that each are irreducibly different complex systems characterised by different autopoietic functioning;

6.2 The significant and related concepts of structural coupling and affective relating;

6.3 The developmental aspects of the individual which emerges from the intertwined aspects of affect (emotion), biology and social relationship which include: the affective mediation of relationships, the earliest of which is the mother-infant relationship, through which the infant begins to learn to regulate and organise his own internal states and to negotiate relations with the external world; the early biological development of the infant brain which is experience-dependent and; the infant's earliest learning as profoundly inter-personal in nature, a feature that remains an aspect of learning throughout life;

6.4 A contribution from psychoanalytic theory on the relational and affective aspects of psychological functioning and the significance for the individual of the capacity to make and 'hold' distinctions in the mind.

6.1 DIFFERENTIATING THE PSYCHOLOGICAL FROM THE SOCIAL

Luhmann makes a distinction between the individual psyche and social systems by the mechanism of his concept of autopoiesis. Autopoiesis as originally described in biological systems, is an account of systems that are *open* to inorganic material that is processed by the informationally *closed* function of the system to produce 'life'. Luhmann makes an abstract interpretation of this process, taking a system's observations of its environment and of its own boundaries (self-environment relations) as the material of the autopoietic functioning. Where the observing system is observing a relationship that it itself is implicated in, such as a system observing its own boundary relations, then the system is functioning autopoietically or self-referentially. The human systems that make these second order observations, 'observation of a relationship', are the psychic and social systems.

Luhmann does not conceptualise the individual mind as being 'constructed' by society. Minds are 'not psychically internalised social artefacts' (Luhmann, 1995: 405). They are bio-psychological systems with their own autopoietic functioning and his formulation of psyche and society is as complex autopoietically functioning systems with irreducibly different operational functioning. There is no overlap in their autopoietic functioning, so the two systems cannot communicate directly with, or 'speak to', one another. However, Luhmann does describe the possibility of an 'interpenetration' of autopoietically separate systems. It occurs where the two systems mutually 'make available' their own complex functioning to the other, such that each can treat the other *as if* aspects of the other's autopoietic functioning are part of their own (italics added) (Luhmann, 1995: 210-218; Seidl and Becker, 2006). A capacity to 'share' some aspects of autopoietic functioning, on an 'as if' basis, is an essential feature of human psychological functioning and I will return to it below.

An aspect of complexity that makes it so useful in thinking about human processes, with their differing biological, psychological and social features, is that the subject matter chosen as a focus for any inquiry will indicate a selection of systems that can be used for an investigation. Luhmann's work could be understood as following from a basic choice of the subject of human 'meaning' and an initial distinction that differentiates between biologically based 'life' and a psyche and social systems based meaning system. This initial distinction between life and meaning he chooses not to pursue further as it lies outside his focus. He then makes a further distinction between psyche and social systems. As outlined in the previous chapter, both process meaning and together create a holistic 'meaning system' but each uses different basic elements (thought and 'communication' respectively) in this processing so they function as separate complex systems.

Luhmann's account of the communicative process from which communications emerge can be seen as a mechanism by which the production of social systems comes about, the 'how' of social production. The 'why', or meaning, of these interactions, lies in the varied affective needs human individuals have of each other. In this chapter I will focus on the individual human, who functions as a complex system with biological and psychological aspects, and the relation between the individual and social phenomena.

6.2 STRUCTURAL COUPLING AND AFFECT

In preparation for a discussion of developmental aspects of human functioning that are relevant to learning, I will make some introductory comments on two significant and related concepts. I will link the rather abstract notion of 'shared' autopoietic functioning with the concept of structural coupling, which is the biological mechanism through which autopoietic functioning in humans can be shared, and I will then elaborate on the human function of relating affectively, something that is often overlooked in accounts of human relations in the social sciences literature where the mode of communicating is taken as being limited to cognitive or intellectualised processes.

Autopoiesis and Structural Coupling

Autopoietic functioning of the human mind means that minds can be influenced by other minds but such influence can only have effect on a mind 'on its own terms'. Management of the actual workings of a mind is not under the command of another mind or another individual acting as a social agent. Like all living complex systems, such as a biological cell, the mind can be 'broken' or 'killed'. This can be done by psychic damage, such as by depriving an individual of social contacts, or by other forms of physical or psychological torture. But, damaging or killing something is not the same thing as having control of its operational functioning.

If the human mind was functionally closed to the extent that biological systems such as the cell are, then the influence of another would be minimal. However, for biological systems such as the human, there are aspects of functioning where self-contained independence is neither possible nor desirable. If autopoietic functioning in the human was limited to its organic (biological) form then inter-human relations would be limited to ecological relating and development or learning in the individual would be distorted by being restricted to meaningless chance experiences of the environment.

What does it mean to say that individual minds can be influenced by other minds? This cannot happen solely functionally, such as by one mind taking functional control of another, because of the separate autopoietic functioning of each. However it can occur in living organisms in circumstances where there is a form of sharing of autopoietic *functioning* that is capable of bringing about mutual *structural* change. This concept, known as 'structural coupling' was used by Maturana to explain how organic, living systems such as neurological systems, that are characterised by functional closure, are nonetheless able to relate to, and influence, each other. In structural coupling, changes in a system's structure are induced by its experience of, and adaptation to, aspects of its environment (Maturana, 1999). The change in the organism is not 'caused' by the environment; the system determines the changes it makes in its own internal structure. But, it does so in response to its interpretation of its 'experience' of the environment, or what 'meaning' any environmental change has for it. Where the organism being

considered is the individual human, the environment is the psycho-social environment experienced by the individual through inter-personal relations.

Before coming to the structural, biological changes that can be induced by human relating, I will first describe the affective aspects of relating, through which biological changes can be induced.

Affective Relating

Relevant to relations between human individuals, are the similarities in the neurological *structure* that support the mind. These allow for a sharing of *function* through the medium of shared affective (emotional) experience, which in turn modifies the underlying biological structures of both parties, in parallel ways. This constitutes a mutual process of adaptation between two individuals, each with a separate identity and internal organic structure, but with commonalities of internal structure and functioning such that shared affective experience can be translated into changes at a structural level. An example of this mutual accommodation between neurological systems producing structural coupling is that which occurs between a mother and her infant. In the mother-infant system the shared neurological functioning comes about through the mutual affective attunement between mother and infant. The mother of a distressed infant 'tunes into' her infant's distress, largely unconsciously, 'feeling' the distress herself and then processing the emotional aspects of it. This allows her to have thoughts, not necessarily all conscious, about the meaning of the distress and what is needed for relief of it, which she can then provide. It is the mother's capacity to 'share' the experience of her infant's distress, *as if* it were her own, that allows her to come up with the best-fitting response for the infant.

In this asymmetrical relationship, mother and infant experience the exchange differently. The mother is (usually) able to think symbolically, so she is able to observe the psychological relations in which she is participating, albeit partially and particularly, and she will have some awareness that the shared distressed feelings are related to her infant's experience. However, for the infant, who cannot yet think symbolically, what is known as his narcissism allows him to experience the relief *as if* his mother's mind

were part of his own mind and he has provided the meaning of the situation and the accompanying relief, for himself. In this example the mother and infant are treating each other, in a fleeting communication, *as if* they share the same mind, although for the infant it is not subjectively an 'as if' experience but is experienced by him as a concrete reality. This psychological communication is brief; it is a dynamic function with maternal and infant aspects; an active link that exists only in its action (Bion, 1962).

This form of relating, where two minds temporarily function as if they are one in relation to some specific issue, is a human capacity which underpins all inter-personal human relating. Its use persists throughout life, unnoticed consciously. The individual uses it for support in the emotional management of inner affective states through life, usually with more insight than is available in infancy. It is the medium of connections between specific individuals, whether in an intimate relationship with each other or in temporary face-to-face contact. It is an experience which forms the basis of empathy between individuals, the ability to 'stand in someone else's shoes'. Because it functions as an experience of the commonality of much human emotional life, it provides support in the management of the inevitable differences between individuals in inter-personal relationships. It also functions in the 'division of (emotional) labour' in intimate relationships where a shared unconscious belief of both parties may be for example, that one partner is strong and the other partner vulnerable, or that one has sense and the other is 'the sensitive one'. It is the source of social curiosity and underlies shared cultural activity. Its significance depends on its context. It is of relatively less significance where, say, two colleagues are managing a work situation and of relatively more significance in intimate relationships. Being able to share affective states is of crucial developmental significance for the infant. As illustrated in the example above, it is a mechanism essential to the immediate survival of the infant. However, it is also essential to the infant's biological development. Multiple episodes of such affective relating between mother and infant have physiological effects in the infant's body, which is the mechanism through which structural coupling is realised, to be elaborated on below.

When the psychological is differentiated from the social it is possible to look at aspects of human experience which, although socially shaped from the very beginning, have an individual biologically based aspect. Attempting to understand the emergence of the mind involves thinking about the relationship between the biological substrate of the brain and the affectively-mediated social relationships between individuals, the developmentally first of which is that between mother and infant. The outcome of this linking of biological and inter-personal means that throughout life, the intellectual work of thinking, relating to others and learning, particularly learning from experience, are not abstract activities. They do not have only social significance; they also have personal meaning for the individual being, meaning suffused with affect and bound up with the somatic experience of the body.

In what follows, I will confine discussion of aspects of biology and psychology that underpin learning, to the very early developmental life of the infant. This is because I want to highlight the way in which the inter-personal and intra-psychic connections that are related to learning, develop from interactions involving the intertwining of biological development with affectively mediated human relations. These connections continue and are modified throughout life but their functioning is shaped by early influences. In any complex system, the history of the system is alive in its current functioning in the form of the system's constraints and affordances. So it is with the human mind and its capacity to learn.

6.3 EARLY DEVELOPMENT: AFFECT, BIOLOGY AND RELATIONSHIP

Learning is an embodied and socially modulated affectively-based processing of experience to produce meaning, and is present from the beginning of life. In this section I will elaborate on the way in which affective functioning, biological processes and social relations are implicated with each another in this aspect of human functioning.

Affective Functioning

I first want to consider the concept of affect, which I have linked, above, with emotion. Affect has a central but neglected place in consideration of human functioning. It is

poorly formulated even where it is used as a concept, in the neurosciences and within psychoanalysis (Jurist, 2005). This suggests that affect encompasses complex processes, many of which are unconscious or tacit in nature, and which resist any linear exposition. While the term affect is commonly used to denote experienced emotion, as a concept affect can probably be best understood as a relational function of the mind: affective functioning, for the processing of raw experience. The conscious experience of emotional states, of meaning and of understanding (learning) may all be understood as emergent from affective functioning.

The word 'affect' comes from the Latin *ad*, meaning 'to' and *facere*, meaning 'to do'. One of its dictionary meanings is given as 'the emotion that lies behind action' and 'complex of ideas involved in an emotional state' (Chambers, 1883). It does encompass emotion in the sense usually intended by the word. This is the emotion that can be experienced consciously and can be categorized: emotions such as 'happiness', 'sadness', 'perplexity', 'anger', 'disgust', 'surprise' and so on. However, affect also refers to a range of qualitative psycho-biological experiences that are not usually described as emotions, some of which are known experientially but resist representation in language.

Some of these phenomena illustrate the way in which time is an element of affect. They are the rhythmic qualities which give a 'shape' to experience. Observation of the earliest emotional exchanges between mother and infant make this rhythmic quality visible. While there is the wider context of the more obvious rhythms of the infant's life such as sleep/wake and hunger/satiation, emotional exchanges between mother and infant have micro-rhythms of their own. They are experienced by the infant as what are known as 'vitality affects'. These are the experiences such as 'rising', 'falling', 'fading', 'surging', 'exploding', etc., that characterise the dynamic pattern, or rhythmic contour, of the state of arousal (alertness) of the infant in emotional exchanges with the mother (Stern, 1985: 53-61). Vitality affects have somatic or bodily correlates. They are experienced from the beginnings of life when the developing mind is experientially less differentiated from the body than it later comes to be. They developmentally predate and underpin the later categorical affects, as illustrated in linguistic usage: 'a surge of

anger', 'a shock of surprise', 'a wave of pleasure', 'falling with exhaustion', 'bursting with energy'. They form the important aspect of lullabies and can be seen in the later human enjoyment of activities such as music and dance, where it is the 'emotional shape' of the activity, rather than any cognitive, intellectual content, that carries the meaning of the work. They are that aspect of poetry that interacts with, or sometimes replaces, the language-based cognitive content of a poem, as a way of conveying the meaning of the work.

Affect also includes other qualitative psycho-emotional experiences not commonly recognized as emotions, such as those of 'newness', 'recognition', 'discordance', 'empathy', 'rightness', 'desire', 'satisfaction', etc. These experiences are relational in that they make reference to other states. 'New' implicates 'old', 'desire' implicates its object, and so on. In the dictionary terms of being the 'emotion that lies behind action', affect can be understood as being the subjective experience of what constitutes the 'meaning' of an experience for an individual. It pervades our lived experience: '*I* know that', 'That doesn't *feel* right', 'That's *true*', and so on. These experiences are the psycho-emotional outcome of an *experience of* something from inside or outside the mind that has been *engaged with* by the mind's internal processes. The phenomena described above that come under affect as an umbrella term, all carry emotional meaning. This suggests that they can be understood as emergent from the complex system of the affective functioning of the mind.

Biology

Developmentally, social relationship is the means both by which we survive and by which we become human. The human individual is born, as mammals are, while still relatively undeveloped, which means that the newborn infant requires an extended period of nurture for maturation to independence to occur. While the need for nurture of most biological aspects of functioning is obvious, the developing infant brain also needs appropriate socio-emotional contact with adult human minds in order to develop structurally. This is the way in which the individual becomes recognizably human and at the same time it contributes to the uniqueness of every individual. This claim is

supported by the linking, in the last decade or so, of several bodies of research work. One of these is an area of developmental psychology which looks at the interactions between infant and carer and the qualities of the resulting emotional bonds. These findings can be linked with outcomes in areas of adult functioning, particularly those related to the capacity to think symbolically (Goldberg et al., 1995; Holmes, 1997). The other body of work is that of the developmental neurosciences, which look at the psycho-neurobiological mechanisms of the structure and functioning of the developing brain. This linking allows a better understanding of the interrelation of psychology and biology that underpins human development and which is needed to inform any theories of human learning.

Any psychological experience, such as a thought or a feeling, is mediated by some activity at the biological level of the brain. New learning involves a shift, however small, in the biological structure of the brain. It involves processes of making of new links, strengthening of current links, neglecting earlier links, the significance of which then fades, within the neural network of the brain. The plasticity of brain function is contained in this capacity of the neural network to constantly forge change in the neural connections that constitute pathways within the network. It is this plasticity which makes any form of development and new learning possible throughout the life-span.

Biology in the Early Development of the Infant Mind

The function of the brain/mind could be summarised as threefold: managing the inner world; relating to the outer world and making sense of the relation between the two. That is, the monitoring and regulation of internal psycho-physiological states, the observing and engaging with external environmental circumstances, including the social environment and the management of the relationship between the inner and the outer worlds. All these functions can be understood to be in the service of the survival of the individual, for the survival of the species.

Current thinking about this capacity to manage the self is that it is primarily a function of areas of the right hemisphere of the brain, specifically the right frontal cortex, and its linked deeper structures. These areas of the brain are known to have a critical

developmental period which occurs between sometime before birth and somewhere from two to three years after birth, that is, specific development of these areas of the brain must occur during that time period. The mechanisms of development of these areas of the infant brain are based on complex relations between the unfolding of genetic and other biological processes and the biological and social environmental influences which enable or constrain the process of maturation. Social experience, mediated by social relations, makes an essential contribution to psychobiological maturation. Early interpersonal events have an impact on the developing structural organization of the brain and thus influence the brain's future functional capacities. For example, there are links between the emotional experience of shame and blood cortisol levels on the one hand and between cortisol levels and the pruning of the connections between neurons in the brain, on the other. This implicates the shaming of an infant during an early critical period with the production of effects in the biological material of the brain. These are effects that will last beyond the immediate experience of the infant and, because of their biological aspects they will influence how the individual later responds to shame-inducing experiences. This kind of phenomenon is not just a side-effect of social relating. The brain is 'hard wired' to be moulded by the specific human relations it encounters in the early social environment. Its development has within it an inherent requirement for the social experience-dependent shaping of its actual biological structure (Schore, 2000, 2001, 2002; Fonagy et al., 2007).

An organizing function of the infant's brain maturation is the infant's need for regulation of internal levels of arousal (alertness) and affective states and behaviours. This regulation involves managing a range of stimuli. There are the internal sensations from the viscera, such as hunger or colic pain and from the musculoskeletal system, such as bodily position, balance and movement in space. There are also stimuli that come from the external world, experienced as the bodily perception of temperature, taste, visual experience and so on, and stimuli from the external world which have a social origin and are experienced affectively.

The social aspect of development at an early post-birth stage is mediated through the infant's relationship with a primary care-giver, commonly the mother[8]. The most important social stimuli for the very young infant are the interpersonal, non-verbal, affective communications conveyed by the touch, gesture, facial expression, vocal tone and prosody of the mother. The social relationship between mother and infant is expressed in these affective exchanges which are processed in areas in the right brain hemisphere with strong links with the arousal and emotion-processing areas deeper in the brain. They integrate the infant's experiences, from the external world and internal, somatic or bodily world with his emotions.

The integration of social experience and biology allows the storage of early experiences in the form of implicit memory. This provides the infant with tacit, somatic- and affect-based working models of himself, his body, and his relations with the external world (Schore, 2000, 2001). These models in turn provide a basis for later developing capacities, such as more complex cognitive functions including language. These later developing functions do not lose connection with their tacit, somatic and affective origins and are, in part, shaped by them. Even complex abstract intellectual activity in the individual, has affective connections and therefore affective significance, or meaning, for that individual.

Affect in the Early Development of the Infant Mind

Infants have different inborn temperamental traits which they bring to their early relationships and each infant, even siblings, is born into a 'different' family: a family at a different stage of its life and with a differing constellation of family relations. Each co-constructed mother-infant relationship is different from any other: the same woman is a different 'mother' for each child; different infant temperaments match different maternal styles of mothering; mothers learn from experience; life events impinge on the mother-baby relationship. Difficulties are part of this emotional process even with experienced parenting. There is a large body of literature from the fields of infant

[8] I will use the term 'mother' as shorthand for what is more properly thought of as the 'mothering function' which, of course, can also be undertaken by the father and adults other than the literal mother.

observation, attachment theory, child and adolescent psychology and the psychotherapies that link significant disturbance of this process with various later disturbances in psychological or social functioning. This includes difficulties in interpersonal relating and in the functioning of internal, intra-psychic relations, as reflected in the capacity to think, particularly to think symbolically, which, as has been described, depends on a capacity to observe relations, including one's own. Much of what is done by the mother is done intuitively because much mother-infant exchange occurs outside the conscious awareness of either. For example, slowed split screen recordings of mother-infant interactions, which make available concurrent frontal facial views of both mother and infant, demonstrate that infants perceive and react to maternal facial expressions lasting only milliseconds, which are therefore out of the conscious awareness of both mother and infant. This means that much of the mothering function cannot be learned as a conscious, cognitive (by which I mean being formulated using language), procedure. It has been learned experientially by the mother during her own infantile life, is shaped by her later emotional experiences of life and is modified by her experience of the particular infant she is relating to in the present.

The biological development of the infant's brain described above comes about in the context of the infant-mother relationship. At the pre-verbal stage this relationship wholly involves affective level communication. Mothers and infants spend time mutually engaged in affective exchanges. The mother responds to her infant's attention with a matching attention and mother and infant engage in emotional exchanges, using gaze, vocalisation and touch, to interact. The mother synchronises the rhythm of the engagement, matching the infant's rhythm of engagement/disengagement. She mirrors her infant's emotional state and modulates it, amplifying or reducing its intensity. As well as episodes of emotional synchronisation, there are episodes of emotional misattunement that have to be recovered from, and periods of separation that the infant has to learn to cope with. It is through the mother's timely and appropriate emotional management of these early exchanges that the infant begins the task of 'learning' how to regulate his own internal psycho-biological states and how to relate to the external world. It is where he develops his earliest qualitative understanding of social

relationship. It is also where the development of his more abstract cognitive capacities, including the use of language for communication, begins. Mother provides words for objects in the external world that he already experiences affectively and as well for his internal and affective states, which she has discovered through her emotional experience of them. This 'naming' of experience links language and affect which gives meaning to the language that is initially specific for the context in which it is being used.

These early affective states and the later categorical emotions that emerge out of them are profoundly linked to the infant's somatic (bodily) experiences. Because the infant's mind is in the early stages of its development, emotions are experienced as bodily phenomena as much as experiences in the mind. This somatic connection is never fully lost. It can be seen in adult life in experiences where emotion and bodily experiences are linked, such as feeling nausea when disgusted, or dry-mouthed or tremulous when anxious, or fainting when emotionally overwhelmed. These connections, like the vitality affects, are reflected in our language: 'I felt sick with excitement' or 'She was flushed with pride'. Sometimes an account of the somatic experience stands in for any specification of the associated emotion: 'When I saw him I just melted' or 'The hairs on the back of my neck stood up' or 'That made him froth at the mouth'.

Structural Coupling in Early Development

The very early mother-infant relationship illustrates the workings of autopoietic structural coupling. It is one which involves two neurological systems, that of mother and infant. The mechanism of the coupling is by sharing of affective states. The affective states of one partner are induced in the other and vice versa. This happens, with variations, repeatedly over time at a stage when the infant's brain is both developing rapidly and is primed for structural shaping by the different neuro-chemical states that the affective exchanges induce in it. The affective communication between mother and infant has, over time, a direct effect on the biological structure of the infant's brain, drawing some neural structures in the infant's brain into alignment with the same structures in the maternal brain, hence *structural coupling*. It is the mechanism whereby the aspects of parental brain structure, through the medium of

shared functional affective exchanges, is able to influence the structure of the developing infant brain. The rhythmic patterns and emotional qualities of the mother-infant relationship literally shape parts of the infant's developing brain and this shaping, in turn both constrains and enables the infant's later affective capacities and experiences. Such structural coupling also has an effect, although less marked, on the mother's brain. It is through this affective relating that the mother gets to 'learn' who her infant is. She may later formulate her experience using language, but her fullest 'knowledge' of her infant is in the direct, tacit, psycho-biological experience of him.

This is the first 'learning' that the individual engages in and it occurs from the very beginning of life. In the beginning it is not a cognitive (that is intellectual), conscious or language-based learning. It shapes the individual but is a profoundly relational experience; a somatic and affectively based, non-conscious form of learning. It is learning how to regulate internal states of the body through organisation of the developing mind. It is learning how to appraise and attribute meaning to experience by using the presented human environment to do this. The infant has to learn by making affective use of the available minds of others, with whom he must form relationships. This is where learning begins and the experiential features of this early stage of life, specifically affective, somatic and relational experience, permeate all later forms of learning.

Relationship

As a new-born, the infant does not yet know what a human relationship is. He has not yet encountered another as 'other'. In the example of a mother's management of her infant's distress, above, the mother knows that in experiencing her infant's distress, the experience is 'as if' she were the infant. The infant experiences his mother's mental capacities *as* his own, rather than *as if* they were his own. This is necessary while his own capacities to think for himself are still developing. His psyche would be overwhelmed if he were forced to experience the reality of his total vulnerability before he had developed the necessary psychological mechanisms for coping. However, one of the developmental tasks for the infant is to begin the process of discovering human

relationship and the necessary dependence on it; the process of discovery modulating the dependency.

Discovery of relationship is important for a number of reasons. There are situations where maintaining a physical proximity to a known caregiver may be essential to survival. However the aspect that is of direct relevance to learning is to do with the capacity to make distinctions between self and another; or self and the external world. The way in which relationships are managed in the mind determines the individual's capacity to make such distinctions both with respect to the external world and intra-psychically, as reflected in the capacity to think symbolically. Symbolic thinking is the mode of thinking which is necessary for the individual to be able to differentiate between relationships which are concrete and those which are of the mind, 'as if' relations, an understanding of which is necessary for the development of the capacity to learn.

Understanding the relations between any two individuals, such as mother and infant, is difficult. The mother-infant relationship can be seen as a two-party complex system. Complexity theory formulates what we know from experience: that there is no direct way of 'knowing' a relationship between two people, other than by being a party to it. Even as a party to a relationship, for any one person, the knowing can only be partial; the whole of the relationship cannot be grasped. A range of techniques can be used to study different aspects of the significance of relations in the developing mind. Various forms of observation and more structured experimental research on mother-infant relations provide information such as that above. Another approach to understanding the significance of relationship in human life comes from the psychological therapies which can be grouped under the term 'psychoanalysis'.

6.4 A CONTRIBUTION FROM PSYCHOANALYTIC THEORY

Psychoanalysis, a therapeutic practice, has developed its own bodies of theory over time. I wish to use particular psychoanalytic theory to illustrate aspects of the issue that I am arguing in this thesis in relation to the conceptualisation of learning as a process of

discovery/creation of meaning, within inter-personal relationships, and the significance of the individual's capacity to make distinctions internal to the mind for this process.

In what follows I will use the term 'psychoanalysis' or 'therapy' interchangeably for work, derived originally from the clinical work and thinking of Freud, but developed through the years of its practice since that time. In particular what follows is informed by those strands of theory known as 'British object-relations' theory and the 'post-Kleinian' work of psychoanalyst Wilfred Bion. In Object-relations theory, as the name suggests, the workings of the mind are conceptualised in terms of relations. Relational issues have become of central significance to psychoanalytic thinking since the shift in the 1950s from thinking about the mind as containing 'objects' to the mind as 'being relational processes'. Therapy has as its working tool the use of a human relationship, that between analyst and patient. In these therapies speculations can be made about intra-psychic relations, themselves shaped by earlier life relations, but the essence of the work is a joint discovery, in the therapeutic relationship, of things of current significance to the patient, not known to either party before their discovery.

If an individual therapy is conceptualised as a complex system, the system's attractor is the joint purpose of discovering and understanding something meaningful about a source of distress for the patient. The relationship between patient and therapist is asymmetrical, as Deweyan trans-actions are. That is, while there is the shared purpose, in the form of discovery of something of significant meaning for the patient, each party has a different role in the relationship, one that complements that of the other. The purpose of the therapy is to understand something about the emotional truth of the patient's situation in such a way that the patient's understanding of his or her situation changes. Such understandings are not the result of abstract, intellectual calculations. They cannot be achieved through the 'application' of theory, nor do they result from the therapist communicating, broadcast style, some pre-existing 'truth'. They can best be understood as co-constructions, emergent from the complex system of communication in the therapeutic relationship. This relationship needs to be based on a shared presence between two individuals because thinking and discovering meaning are inseparable from affective processes and all are biologically mediated and bound to the presence of

the individuals involved. That this therapy uses a relationship as its basic tool makes each analytic therapy individualised. It is experientially unique and it deals in individual and unpredictable ways with variations on the themes of common human vicissitudes.

The individuality of each therapy influences the relationship between practice and theory in psychoanalysis. Psychoanalysis is a field where theory is intimately bound to practice but in a way where theory is clearly derived from practice, rather than practice being an 'application of theory'. In much of the psychoanalytic literature, case history material, in the form of de-identified clinical vignettes from individual therapies, is used as the evidential support for theoretical claims. Practitioners have a relative resistance to generalising in relation to theory. An aspect of this community of practice's knowledge is an awareness that claims about meaning are provisional, defeasible and evolving, both in an individual therapy and at the abstracted level of psychoanalytic theory.

It will be clear that I am not referring to the use of psychoanalytic theory which has been disengaged from its experiential origins and used in a purely theoretical form as it is in some areas of academia. This use of theory can be problematic, as for example, where it is used in the theoretical 'psychoanalysing' of an individual who is, for example, the subject of a biography. This use of theory, like the promulgation of the theory 'evidence-based medicine' as a practice, reflects the difficulty we have in how to conceptualise the relationship between theory and practice.

Concepts from Psychoanalysis Related to Learning

There are two aspects of psychoanalytic theory relevant to the concept of learning that I want to discuss. They are essentially to do with the linked concepts of relationship and distinction respectively.

The first aspect is the idea that the process of thinking came into being as a 'container' for affective states in order to manage the somatic and affective states that result from the experience of living. This creation of internal relations, which can be modelled as Deweyean trans-actions, both manages internal states and produces thoughts for use in

social communication. In systems terms, this is a model of the mind as being a process of complex trans-actional relations from which thoughts are emergent.

The second aspect relates distinctions in the mind. They are the distinctions that develop out of an initial capacity to differentiate between internal subjective experience and an external reality that is not under the individual's omnipotent or omniscient control. Mastery of this basic distinction in its various aspects is necessary for the individual to survive and function adequately in the world, as distinctions internal to the mind allow symbolic thought, which in turn allows the individual to make/recognize distinctions in the external world. In systems terms this means that the system (the individual) can know the external world by changes internal to itself (the individual body/mind).

Internal Relations as a Container for Affective States

The first concept was proposed by the British psychoanalyst Wilfred Bion, in work published in the 1960s. It is that in the human, the capacity to think developed in relation to the need to manage affective states in order to function adequately to survive. This concept has links with Dewey's understanding of life: that for the individual, life is an on-going experience of equilibrium-disequilibrium - equilibrium that results from trans-action with the environment (Dewey, 1986: 34). Bion understood thinking as something that comes into existence for the purpose of managing the disequilibrium evoked by the stimulating, puzzling or disturbing experiences that result from life, experiences both from within the body/mind and from the external environment. He conceptualised the relations in the mind that manage the disequilibrium in a way that echoes Dewey's creative trans-actions. He used the term 'container-contained' for this to indicate that disturbing affects are not simply contained, as water is contained in a glass, but that containment is an active *relational process*. Further, it is a creative one, in that it serves the purpose of managing disturbing affect, but it also produces something new, in the form of meaning-bearing thoughts. These thoughts can be used in turn, to function in future container-contained relations or they may be used for inter-personal communication. In his work Bion proposed a series of models to describe the development of the capacity to think, but all are based on the notion of a creative

relationship in the mind 'where there is an inherent expectation of a union of two objects to make a third which is more than the sum of the two parts' (Hinshelwood, 1989: 443).

Bion understood psychoanalysis as an investigation of how a human mind functions. His work was grounded in his experience of the clinical encounter. He understood this encounter as an investigation of what happens when two minds meet and how this meeting can be used to understand the individual's development of the capacity to handle emotional truths. The emotional truths include the inescapable 'facts of life': the individual's origin in total dependence and continued dependence on others; the limits of the individual's capacities and the finitude of life itself (Money-Kyrle, 1971). These emotional truths are related to the individual's discovery of his own human limits which, although it may sound paradoxical, mean a discovery of who he himself is, as an individuated being with his own agency. Discovery of these truths, in the specific form that they have for an individual, can bring with it a sense of loss that has to be managed, but resisting or evading these discoveries can itself be the source of much psychic pain. It is the unique form in which the individual person acknowledges and accommodates these truths that gives shape to the individual experience of life.

For Bion, thinking has its origin in the bio-psychological processes of infancy, in the infant's need for management of disturbing bodily-emotional states. The way that this is initially managed within the mother-infant relationship, and the way that the infant learns from the experience of this relationship, determine the development of his later capacity to do this for himself. The new-born infant has an in-built biological expectation of relationship. 'Hard-wired' into the infant brain, in the form of a bodily reflex, the sucking reflex, there is a neurological preparedness for the infant's mouth to meet the maternal nipple. Bion proposed the container-contained relation of the mind as a bio-psychological concomitant of this relation. He proposed that in the infant's developing mind there is a parallel, innate, accompanying state of emotional expectation which, when it is met by the mother's capacity to engage with her infant in thinking about his needs, produces an emotional experience that parallels that of the infant mouth

finding the breast. The connection is creative in that it brings an emotional experience of understanding and satisfaction for the mind.

Learning about how to manage bodily-emotional experience begins for the infant with his mother's capacity to think about his internal states, as just described. The infant initially does not know that, say, the pain in his stomach is hunger; he may experience it as something attacking his body or eating his insides. Nor can he conceptualise what needs to be done about the problem. What does need to be done relates to his mother's capacity to contain her infant's distress in her own mind. That is, to experience the distress as if it were her own distress, and at the same time to be able to reflect on it in a way that will allow her to respond in a timely and adequate manner, resolving the problem. This unconscious process of the mother containing and reflecting on her infant's state is a form of inter-personal 'container-contained' relation. Its outcome can be an immediate response which provides the infant with the experience of relief and satisfaction. But there is also a longer term outcome which is related to the development of the infant's capacity to think. This experience is repeated and repeated over time, with variations on the central issue and recovery from failures in its management. It is this, through the bio-pyschological mechanism of structural coupling that allows the infant's own capacities to develop. What is internalised by the infant is the *relational process* of his mother's capacity to think. As he learns how to do this, he is increasingly able to contain his affective experience for himself by engaging in a, largely unconscious, reflective thinking about it.

Thus, thinking can be understood as an elaboration, in the mind, of a series of active relations of containment of one thing by another: of emotion by thought and, at a developmentally later stage, of thought by words (Hinshelwood, 1989). In describing containment as 'active', Hinshelwood is indicating that Bion's idea of the container-contained relationship is a Deweyean trans-action, capable of producing something new. The use of words facilitates and broadens the scope for communication as the child develops, giving him access to new relationships.

Where the capacity to think is limited by intellectual endowment, or has not been able to develop, or is temporarily hindered by say, anxiety, then painful affective states that need containment may be managed in other necessary but less productive ways. More primitive, that is, developmentally early, mechanisms of thinking may be called on. We are familiar with the situation where an individual who is usually capable of reflective thought, when acutely distressed, may cling to certainties, seeing a situation in terms of black or white, or become dogmatic, or rush to a premature judgement on some matter. They may lose their capacity for humour and imagination, or feel persecuted by an external 'cause' of their state of mind, like the infant 'attacked' by his own hunger. If intra-psychic mechanisms are inadequate, painful affective states may have to be contained by physical activity, such as pacing, or punching a wall or hitting someone. The spinning and rocking activities seen in severely damaged institutionalised children can be understood as a form of physical self-containment or 'holding the self together'. Painful affective states may be contained somatically in the body, causing physical symptoms, such as anxiety causing a rash. They may be contained by maladaptive interactions in social relationships where the individual may have the (unconscious) belief that he can rid himself of a painful affective state of mind by inducing a similar state in another person and then disavowing its connection with himself. The mechanism goes something like: 'I'm not small and frightened, she is the one who is small and frightened, and so I'm the big and powerful one.' When we are on the receiving end of such a disavowal we may come away from an interaction with feelings that, on reflection, seem to be excessive for our investment in the situation, as if we have taken on someone else's feelings for them, or more correctly, that our own capacity for such feelings has been excessively stirred up. However, the management of painful internal affective states is only one possible use of such a process. The human capacity to induce affective states in others also functions as an unconscious mode of communication between individuals.

Interpersonal Relationship as a Container for Affective States

We use the capacity to communicate affectively for multiple purposes because all direct human communications have an affective component. As seen above, this capacity has

its developmental origins in the early mother-infant relationship as a mode of survival. Even though the developing child begins to take over much of the work of processing affect, that is, thinking, that was initially done for him by his mother and other adults, the use of social relations for help in managing affective states continues throughout life. This use of the other's mind, often shared by the other in a complementary way, takes the form of unconsciously communicated beliefs about the self, the other and the relationship of both. A couple may unconsciously make a 'division of labour' in relation to affect. An individual may experience either unwanted or valued qualities or aspects of himself, as 'belonging' to another with whom he then relates as if this were reality. Examples are contempt for someone seen as greedy or the idealisation of someone regarded as containing all the goodness of the relationship. The human need for these affective exchanges both makes relationship necessary and functions *as* the qualitative relationship.

The affective exchanges between individuals are what make a group 'feel' like a group rather than a collection of individuals. They are what allow a group which has adequate face-to-face contact, to function as a 'networking' of minds. Hence the knowledge that groups, small enough for members to be known adequately to each other, make a productive management form for human problems. This is encapsulated in the adage 'two heads are better than one'. In complexity terms, such co-present groups have greater complexity than either the individual psyche or a crowd, where lack of personal connections between members limits affective communicating and makes relations between individuals proportionately less complex, hence the experience of crowds that they 'think' in simple, developmentally early, ways and may act primitively.

Affect and Abstraction

Bion's conceptualisation is that thinking came into being to provide a container for affect, taking over from the inter-personal containment of it between infant and mother as the infant develops. But both thinking, an internal process, and inter-personal communication, the social process, continue throughout life to have affective components. Because affect is biologically mediated it has an integral connection with

the individual mind. The affective aspects of communication, conveyed by expression, tone, posture, gesture, are non-verbal and require some form of vocal or face-to-face context for communication. Where communication is in a mediated form, such as communication by the written word or electronically, this context is reduced or absent, so there may be a loss of the affective aspect of the communication and with it, its associated meaning. Most people are familiar with how relatively more easily misunderstanding can happen with communication by email in comparison to, say, telephone communication where visual contact is also lost but vocal intonation is preserved. Mediated, (written or electronic) communication, being abstracted, has less complexity than direct communication. Because there is more uncertainty about intended meaning, more interpretive work on the part of the recipient is required. Even with such work, because it is interpretive, the communication as a whole contains greater uncertainty.

It is the affective components of experience that are left behind, by degrees, in processes of abstraction of producing social structures, from communications to social systems. Reduction from the lived experience has already begun internally with the formation of conscious thoughts; inter-personal communication involves further abstraction or relational reduction. In Luhmann's account of communication described in the previous chapter, the individual making an utterance has selected the information to be communicated. In making this selection he is also making another selection, described as 'the form and reason for a communication: how and why something has been said' (Seidl and Becker, 2006). This 'how and why' is the affective component of the utterance. It 'holds' the intended meaning of the utterance. Of course, the receiver has an affective response of his own to this. It contributes, largely unconsciously, to how he interprets what is intended and how he makes his own selections in the communication process.

Distinction and the Mind

The second aspect of human functioning which is relevant to learning, and is illuminated by experience from psychoanalytic thinking that I wish to discuss, is that of

the place of making or discovering distinctions. An aspect of learning is based on the capacity to differentiate between internal, subjective or intra-psychic reality and external reality. Being able to do this adequately allows an individual to be able to manage his own survival, negotiate the social world and pursue his life meaningfully. However, like the need for relationship, the need to be able to make distinctions is something that the infant has to learn by experience within a relationship. Money-Kyrle's 'facts of life' referred to above, which are to do with the necessity of relationship and the natural limitations of human capacity can be seen as distinctions which refer to human limitations but which also refer to the creation of life and identity. We don't create ourselves as an individual alone cannot create human life; we live our lives with constraints that are not under our control, but it is in the degree to which we can accept our limitations and tolerate the constraints of life, that the possibility of living creatively lies.

For the sake of psychic survival we are born into almost total omnipotence, so the central psychological discovery to be made by the infant is the 'me-not me' distinction. This is a developmental process that takes different forms over a life-time. The shock of every new experience or discovery is part of this on-going process. The process is implicated in the infant's first discovery of himself as a living agent and his eventual individuation from mother, parents and family of origin. It underpins all desiring: the passion for, pursuit of, or curiosity in everything that we have an interest in, and so it shapes what we feel and how we live. The earliest experiences that allow the infant to begin to make 'me-not me' distinctions are experienced within the mother-infant relationship. So, like the discovery of relationship, of which it is a part, making distinctions is a socially based process which the infant uses in his developing capacity to recognise and manage his own affective states.

One of the aspects of the 'me-not me' distinction encountered early in the infant's life is that of his experience of maternal absences. These may be the literal absence of the actual mother, as parts of her own life exclude her infant. They also include the failures in attunement which are a normal part of maternal-infant relating. The term 'failure' here does not have negative connotations. Failures in attunement cannot be avoided and

are actually needed for developmental purposes. What is important is how they are handled by the mother. If she recognizes them and attunement is re-established in an adequate and timely fashion, the infant will be able to internalise the experience as a process of 'loss and recovery'. This makes any current loss of attunement not the catastrophic experience it might otherwise be because there is the potential for recovery. With multiple such experiences the infant also learns in a more general way that losses can be recovered from. Even the mirroring that goes on in the mother-infant attunement interactions contains unconscious but purposeful episodes of mistiming or asynchrony. This allows the infant to experience separation and reunion as part of learning that he is a separate individual. At a certain developmental stage, a state of merger, albeit illusory from an external perspective, is as terrifying for the infant as one of total separateness, as each involves a loss of self. These episodes of misattunement allow the infant to discover that he is a separate individual *in a relationship*. He learns that a relationship with another human can be used for coping with stressful situations as well as producing pleasurable and creative ones. He also learns that an internal relation, that is thinking, can be used in a parallel way. These episodes can be seen as parental preparation of the infant for the experience of life as the process of equilibrium-disequilibrium-recovery of equilibrium described by Dewey.

Distinction Embodied: Transitional Phenomena and Potential Space in the Mind

The alternating presence and absences of the mother provides an impetus to thinking as an affect-management strategy. When the infant is hungry (for something) but the breast is absent, the infant has an emotional experience not of satisfaction but of frustration[9]. This frustration is the awareness of the gap between *internal* wishes (the hunger for) and *external* reality (absence of the breast). The very early infantile experience of this situation is that the breast, if not present, does not exist or, does exist but as a persecuting presence, a dire situation for a dependent infant if it were reality. However, when there is a developing apparatus for thinking, then a thought can arise, that of being aware of the 'absent breast'. The thought contains the idea that the mother's breast still

[9] In this discussion, 'breast' like 'mother' can be understood as reference to a function rather than to a literal object.

exists, even though currently absent, which leaves open the possibility of its return. This thought can link with the affective experience of frustration, in a container-contained relation to make the frustration bearable and the painful experience of the absent mother more manageable for the infant (Bion, 1962, 1967). This opens up future emotional work to be done, in the form of mourning the loss of the illusion that mother is an aspect of himself and therefore under his omnipotent control. But it also brings the pleasure of anticipation of reunion with a more realistically known mother. This discovery of the existence in the mind of something that is not concretely present and not under one's control is the discovery of a symbol, a thought that can represent something that is concrete but absent and thus exists but is 'other'. It is the beginning of the capacity for symbolic thought.

At a later point in his psychological development the discovery of the distinction between infant and mother, inner world of the mind and external reality, can be seen enacted. This is the commonly observed phenomenon of a child's use of a favourite toy, a corner of a blanket, scrap of material or some other, usually soft or fluffy object, from which it is distressing for the child to be parted. The child selects this object, it is not selected for him and the child insists that it must remain unchanged for the duration that it is needed. Its purpose is to remain constant indicating that it can survive whatever treatment, hostile as well as loving, that the child gives it. The children's book 'The Velveteen Rabbit' (Williams, 1992), first published in the 1920s, is an account of this childhood experience.

The British psychoanalyst D.W. Winnicott used the term 'transitional object' for the selected item, describing it as the infant's first 'not-me' possession (Winnicott, 1974: 1-30). It represents the infant's discovery of the mother as an external 'other' and himself as a subjective being. While to adults the object clearly belongs to the external world, to the child it has a more paradoxical position. It *is* an object in the external world. But in being selected by him for the internal meaning it has, of representing the maternal function which he previously believed was his, it also belongs to his subjective internal world. The significance of the object is that it represents a state of mind where two irreducible functions, internal life and external reality, both contribute and relate to

each other but without being merged into one. The transitional object can be understood to represent an internal space that both arises from, and contains, the mind's capacity to make a distinction between the inner world and external reality; between self and other.

The distinction between self and other is discovered by the infant through his relationship with his mother, a mother who has other relationships from which he is excluded, most fundamentally that which she has with his father. The discovery comes as part of negotiating the transition out of an initial state of total dependency toward individuation. For this the infant needs to have been allowed an adequate period of illusory experience of the maternal function being an extension of himself. He then needs to have been disillusioned of this in a timely and appropriate way. This allows the safe discovery of his dependence on the parental relationship. This differentiation between himself and the relationship that gave him life is then represented in his mind as a distinction between subjective self and the other, experienced as external to the self.

To be able to 'hold' this primary distinction of 'self-other' in the mind is crucial for the development of the mind's capacity for thought. To observe a distinction being made is in cybernetic terms, a second-order observation, an observation of a distinction; an entity-context relation, which can offer the observer meaning. Winnicott said of the transitional object: 'It can be said that it is a matter of agreement between us and the baby that we will never ask the question: "Did you conceive of this or was it presented to you from without?" The important point is that no decision on this point is expected. The question is not to be formulated' (Winnicott, 1974: 14). What Winnicott is underlining here is that reduction of the self-other distinction in favour of one side or the other is damaging. Loss of the distinction between self and other means loss of the 'transitional space' that it creates/is contained by. The transitional space, which the distinction creates, is a relational function of the mind. It underlies symbolic functioning, needed for the capacity to think reflectively; to develop a theory of mind, that is, to understand that others have minds of their own and to be able to empathise with another by being able to imagine their experience. The capacity to make a self-other distinction enables the individual to make other distinctions in the external world and hence the judgements about meaning that are necessary to live an ethical and

authentic life and to participate in social and cultural experience (Winnicott, 1974: 122-129).

Another psychoanalyst, Ronald Britton, describes the same issue at a later developmental stage in terms of the infant's understanding of basic human relations. He describes a triangular 'space' that is created by the infant's discovery of two distinct kinds of relationship. These are the two nurturing links that he has with each parent, relationships in which he participates, and the procreative link between the parents, from which he is excluded. Britton argues that if the infant can tolerate his ambivalent feelings about his exclusion from the parental relationship, then a third position, of neither inclusion nor exclusion, emerges. This is a position from which he can observe others, experience others' observation of him and come to be able to observe himself (Britton, 1989). If exclusion from the parental relationship is experienced as too persecutory, the infant learns not to 'see' it. He may therefore be limited in his capacity to observe how other things in the external world are related, impairing his capacity to learn. And he may have a limited tolerance for being observed and experience the idea of being thought about by independent others as persecutory, impairing his capacity for self-reflection, again impairing his capacity to learn. However, if exclusion from the relations of others can be tolerated then the observer position or function of the mind, is available for 'benevolent curiosity', insight and understanding, all aspects of a capacity to learn (Segal, 1991).

Both Winnicott's' 'me-not me' relationship and Britton's observing position can be understood as functions of the mind that depend on distinctions. Another way of understanding them is as a relationship produced by the maintenance of the appropriate distinctions. These distinctions, as can be seen in the clinical setting, are essential to the adequate functioning of the mind. One of the reasons why parental incest can be so damaging for individuals, and perhaps one of the reasons why it is subject to cultural taboo, is that in failing to exclude the child from what belongs to the parental relationship, it makes an attack on the very distinctions that the child needs to discover in order to develop the capacity to think. One of the common effects of incest, and sexual abuse more generally, of young children, can be seen later in life in the form of

an impaired development of the capacity to think symbolically or self-reflectively with all the psychic distress and social disorganization that this can entail.

6.5 CONCLUSION

In this chapter my focus has been on psychological functioning and learning. I have attempted to make three points. The first of these is the usefulness of differentiating psychological functioning, which is based in individual and co-present group functioning, from the more general, larger scale and less complex forms of social functioning, that characterises social phenomena of all kinds, from social concepts to crowds, organisations and institutions. I say useful because, as I will argue in the next chapter, the individual/co-present group functioning is the site of human generativity which includes both learning and the production of knowledge. Where there is no differentiation between individual/co-present group functioning and organisation/institution level of functioning, this understanding is lost, and often even the need to know something about the origins of meaning, purpose, or impetus to activity in organisations appears to be lost with it.

The second point is the need to acknowledge that both biological *and* affective functioning are of significance in human processes. Biological factors are implicated in all learning. The biological development of the brain is shaped by an interaction between the unfolding biological heritage and environmental factors, which include the social experiences of the infant. Learning, both formal and unformulated 'learning from experience', is 'stored', not in any site in the brain, but in the functioning of the brain's neural network, so throughout life what has been learned and the capacity to learn is dependent on brain structure and functioning.

At the same time, affective functioning, which includes subjective experience, cannot be reduced to either biology or to the status of an epiphenomenon of social functioning. It can be understood in complexity terms, as the complex functioning of a system of the body/mind in its relationally-mediated social environment. The meaning of affective functioning consists in the processing and production of meaningfulness. This is done in early infancy largely within the inter-personal relationship with a primary carer/s. In

later life, affect is processed in both the intra-psychic relations of the mind, the mind acting as a function of the co-present group as well as in the inter-personal social relationships of co-present groups. This processing of meaning changes the individual such that the individual can be described as having learned from the experience. At the same time, it also produces, develops, interprets and modifies meaning-bearing social phenomena.

The final point, which is a feature of the previous two, emphasises the profoundly relational nature of human functioning and the importance of distinction making/discovering to this functioning.

CHAPTER 7 COMPLEXITY AND LEARNING

INTRODUCTION

The work of this thesis has been an attempt to address the issue of how to conceptualise an onto-epistemological framework for inquiry in the field of social sciences that consists of learning, practice, learning from practice and producing and using knowledge; a framework that fits more productively with practitioners' experience in these areas than the one we currently use. This is in order to be able to more specifically consider what learning from practice may mean and how social knowledge is related to learning. In this chapter I put together the conclusions about these aspects of learning that I have come to in this thesis. They are theoretical conclusions that follow from using complexity as an onto-epistemological framework and that have some consistency with those already developed bodies of theory that relate to human functioning and the social world which I have reviewed in previous chapters.

In this chapter what is covered is:

7.1 My conclusion that there are problematic limitations attributable to the current substantialist perspective within which social science inquiry is framed; that complexity, as a framework for inquiry, has value for use in the human and social sciences and specifically for those related to the field of learning and knowledge production and use, allowing for a re-conceptualisation of this area that is more consistent with experience and further, that for the social sciences, a non-reductive form of complexity or a general complexity perspective is of more use for this than is the more limited reductive deterministic complexity perspective alone;

7.2 The complex field of co-related complexity concepts;

7.3 The use of a complexity framework to understand the psychological and the social as *functionally* differentiated and therefore irreducible but mutually dependent; and how this distinction on the basis of functionality differs from the substantialist distinction of individual and social 'entities';

7.4 Meaning in relation to the individual and the co-present group: individual psychological functioning is based on bio/psychological processes; the management of affect is of primacy in human functioning; the autopoietic functioning of the mind is based on affective processes; and these are functionally 'shared' in co-present groups;

7.5 Social aspects of meaning: the way in which, following Luhmann, social functioning based in the relationally reduced aspects of interpersonal processes produces meaning; the function of meaning as a social tool, which exists only in its continual interpretation and re-interpretation by interacting individuals;

7.6 The conceptualisation of learning as a process of change in the individual that results from the processing of the individual's experience in co-present groups, by the sharing of affect and participation in the inter-personal communicative processes that produce meaning; the conceptualisation that this co-present group functioning, in turn produces and modifies knowledge for use in practice

7.7 Some practical issues raised by using complexity in considering learning: that indeterminacy and therefore uncertainty is central to generative processes; that complexity reduction via the communicative process is a central process of social functioning; that practice and learning can be understood as different aspects of the one process; and that the use of complexity involves thinking in terms of differentiated systems and the relations between them.

7.1 AN ONTOLOGICAL FRAMEWORK FOR THE HUMAN SCIENCES

The traditional ontological perspective that frames the way in which learning, learning from practice and knowledge are conceptualised imposes significant limitations on the understanding and use of these concepts. This traditional framework is substantialist in form. That is, it reflects a model of the world in which substances or entities have prime ontological significance. Because of this, the relations between entities are commonly either treated themselves reductively as additional entities, or are ignored. I have argued that it is this relational reductionism of the traditional substantialist ontology that is

problematic when considering human processes such as learning in relation to practice. The limitations of Evidence-based Medicine serve as an example of the way in which applying reductive manoeuvres to the complex relations of lived experience, while a necessary aspect of all social level functioning, is problematic if not done in a critical or reflective manner.

A way of re-conceptualising how aspects of life can be taken as objects of inquiry is to use a complexity perspective. Complexity as a framework has a focus that is primarily on process rather than on substance, and on systems that are structured by relations rather than systems that are composed out of entities. Use of complexity as an ontological framework requires an acknowledgment of the indeterminacy of all life and thus, as a field of theory, complexity represents an attempt to come to grips with the indeterminacy of, or the limits to, knowing or knowledge which are necessarily a feature of any endeavour to understand aspects of human experience and of the knowledge that is the 'product' of any such inquiry. As a conceptual tool, complexity can be used to address objects of inquiry which are indeterminate and resist reduction. As there is a need for 'complexity to be met by complexity', complexity tools are needed to address the complexity of the chosen object of inquiry. This is illustrated by the use of complex investigative tools, such as the human investigator, in the processes of qualitative research.

I have argued that the use of a complexity framework, where complexity is defined broadly as general complexity, allows re-conceptualisations of individual and social functioning, which includes practice, learning from practice and the production of knowledge. Currently, most work using complexity theory is based on a reductive form, deterministic complexity. This describes systems of relations which are non-linear, but which can be algorithmically formulated, so deterministic complexity still belongs within a substantialist ontological framework. Deterministic complexity is appropriate for use as a methodological tool in any form of inquiry but its basis in reduced relations limits it as an ontological framework for the human and social sciences. So, a key argument of this thesis is that in order to use complexity to understand human psychological and social functioning, a non-reductive understanding of complexity itself

is needed, one which will address the ontological significance of relations. Complexity needs to be understood as being based ultimately in indeterminate relations, which in turn give rise to systems which are not fully determinate. Conceptualised in this way, complexity can function as a relation-based framework for addressing the functioning of human and social relations and their related systems, in contrast to a substantialist framework which does not encompass the broadly defined relations of general complexity and is limited to accounting for entities or entity based structures.

7.2 COMPLEXITY CONCEPTS

Concepts are used in thinking, so they function as basic tools in inquiry, but as indeterminate tools. A number of the concepts used in describing aspects of complexity are related to each other trans-actionally, such that they can be described as co-relative concepts (Malpas, 2002), as discussed previously. They form a field: indeterminacy/ limits/ distinctions/ context/ generativity/ meaning, where each concept can be used to illuminate the meaning of others. Malpas' example of 'object of presentation' and 'context' as co-relative concepts illustrates the way in which a co-relative concept cannot stand alone as a determinate entity and efforts at defining it independently lead to a circularity, a definition of the concept in terms of itself, for example defining 'context' as 'background'. However, as Malpas points out, recognising relations between co-related concepts does not create 'problematic dualities' (Malpas, 2002). Discovering such circularity, or finding it impossible to make a determinate definition of a concept, can be taken as an indication that the material being dealt with is indeterminate. Such concepts can be understood in functional terms, as parties to or emergent 'products' of, trans-actional relations, rather than as entities. Recognising indeterminate, complex, trans-actional relations can then be used to understand many dualities, commonly considered as problematic, such as body/mind, nature/nurture, individual/social or practice/learning, as irreducible aspects of a complex system of trans-actional relations.

Indeterminacy; Limits; Asymmetry

From a complexity perspective, indeterminacy and the limits that attend it, can be understood in different ways. In Chapter 4, 'Complexity', indeterminacy was considered with respect to the relations of a complex system: it is not functionally possible for every part of a system to be connected to every other part, so any complex system can never be fully 'known' from either outside or inside. Whatever is known about a complex system, there is always something that is not known and cannot be known, thus such systems always have inherent limits in the form of aspects that are unknown. A complexity perspective requires acknowledgement of these limits. It is a perspective that encompasses the human experience of 'not knowing': hence the phrase of Luhmann's that has been given to his work as being 'an ecology of ignorance' (Medd, 2001). This is in contrast to a substantialist epistemology where knowing is conceptualised in terms of accumulation of the substance or entity that is 'knowledge'. This accumulation is hypothetically infinite, limited only by time or by practical constraints, so that what is unknown could or will be known with enough time, research or computational capacity.

Considering indeterminacy in relation to psychological and social complex systems, the deterministic complexity concept of the 'strange attractor' can be used to understand the way in which such systems are indeterminate. Here I am using the concept of attractor as descriptive of a phenomenon that is associated with psychological and social systems. The concept of the strange attractor has its origins in the natural sciences and, as with concepts from deterministic complexity, whether using it in a non-metaphorical way in the social sciences way can be justified is conceptually problematic (Mackenzie, 2005). However because psychological and social systems, following Luhmann, deal with meaning and because of the centrality of meaning to the autopoietic functioning of the human mind, and having claimed that human individuals are affect-driven, where affect encompasses the individual's experience of meaning in the form of 'emotional truths', it seems appropriate to consider that meaning functions as a strange attractor in human and social complex systems.

One of the functions of the attractor is that it defines limits, albeit indeterminate limits. In providing an approached but never realized focus of the complex system it also defines the limit to its sphere of activity and hence the system. For example, in applying a social artefact such as a categorisation system, to any aspect of the complex world, an indeterminate point is reached beyond which a specific category cannot be usefully applied. Returning to an earlier example, if an image of a face is gradually distorted, an indeterminate point will come where it can no longer be said to be an image of a face. The image can no longer function as a social artefact carrying the meaning of 'a face', (or rather, because a social artefact does not itself have inherent meaning, the image will no longer be interpreted as a face). At this point, the limits of influence of the attractor have been reached.

In complexity, the asymmetry of time can be also be understood as introducing limits to a system. In complex systems time is not bracketed out as it can be in linear or deterministic models of systems. Because complex systems are functional systems, time is a component of their existence. As time is unidirectional, it produces an asymmetry in complex system functioning. Complex systems both have a history and they move towards an indeterminate future. The history of a system is embodied in the system's current functioning and for psychological and social systems this 'history alive in the present' forms part of the system's limited autopoietic function, so my history as an individual shapes my interests; an organization's culture facilitates some processes but limits or impedes others.

Relations; Distinctions; Complex Systems and Generativity

While, in every-day life, no-one conceives of relations between individuals as anything other than complex, in social discourse and in the social sciences' literature 'relations' are commonly formulated as the linear relations of logic, derived from Newtonian mechanics, without acknowledgement of the significance of the reduction of complexity that accompanies such a manoeuvre. As already outlined, these relations can be understood as having been abstracted from the broadly defined complex relations that characterise the processes of human life more fully. Linear relations and the non-linear

relations of deterministic complexity can then be seen as relationally reduced sub-groups within the broader definition of complex relations. Such reductive moves are made for the purposes of communication or for the production of conceptual tools for some form of human enquiry or of material tools for use in the production of technology.

What can be said about complex relations? Complex relations are indeterminate. At their heart is something unknown and unknowable that cannot be formulated and can only be observed, as it unfolds, by its effects. Any general account of complex relations can only be observational rather than explanatory. However it is useful to take Dewey's trans-actional relation of the organism-environment co-ordination as an exemplar of complex relations. Deterministic relations, whether linear like Dewey's inter-action or the non-linear relations of deterministic complexity, begin with entities which are then 'put together'. Dewey's trans-actional relation begins with a whole co-ordination and is created as a relation by the making/recognising of a distinction within the whole. The co-ordination of organism-environment is around the point of distinction between them whereby each, by its existence, co-creates the other, while both together make up a system. As outlined in Chapter 5, 'Complexity and the Social', a distinction produces information in the form of 'this, but not that'. As illustrated by the Chinese philosophy concept 'yin yang', yin can be denoted by 'yin' or by 'not yang' because yin/yang makes a functional whole. Dewey's trans-actional relation is a form of relation that functions as a complex system, or rather, as the micro level of a complex system which may generate macro level emergent phenomena. An example is the relation between Malpas' 'presentational object' and the 'context of presentation', described earlier, which is productive of the meaning that each has in the specific relationship in which it is implicated.

Such a structure, a relation or system created/discovered around an internal distinction, appears to underlie the capacity for a relation or system to generate true novelty or to function creatively. In such a system each party brings to the relationship something in common with the other: each is an aspect of a 'whole', *and* something irreducibly different from the other, reflecting an internal distinction in the relation/system. For

complex living organisms, reproduction can take place only *within* a species (shared) but *between* genders (difference). For an individual to be able to find/create meaning from the experience of an event, a capacity for creative symbolic thought, which involves the capacity to hold a distinction in mind, is needed. This distinction is based in the awareness of an internal subjective experience of an external reality, that is ultimately unknowable in any totality or objective sense, but that nevertheless constrains the internal experience. It is from the relation between these two that the individual's own creative interpretation or understanding of the meaning of his or her experience emerges.

7.3 INDIVIDUAL AND SOCIAL SYSTEMS FUNCTIONALLY DIFFERENTIATED

Complexity theory can facilitate an understanding of inter-related human systems. These can be defined as the autopoietically functioning bio-psychological individual, whose affective functioning is shared in co-present groups, and the inter-personally produced social systems. These systems differ from each other in that they have internal relations that differ irreducibly but they are also inseparably interdependent, having a relationship of *emergence* with each other where social level function emerges from interpersonal interaction of individuals and in turn also recursively influences individuals whose activity produces it.

However, the situation is complicated because the differentiation between individual and social functioning is not a substantialist one, made on the basis of substance or entities: it is a *functional* differentiation. In a substantialist understanding, differentiation of individual from social results in an individual mind which is contained by an individual body, and social functioning which is located externally between individuals. However, because the human mind functions autopoietically and aspects of the human mind's autopoietic functioning can be shared, aspects of psychological functioning can be 'shared'. This means that psychological functioning is not wholly intra-psychic and cannot always be equated with the individual person in isolation from their significant relationships. Aspects of the functioning of co-present groups,

including the creation of meaning, depend not just on the visible social process of a group but also on the functioning of a group 'mind'.

This non-alignment of 'psychological' with the 'individual' or 'intra-psychic' poses problems with terminology. In the discussion below I will continue to use the term 'individual' not to imply that individuals function in isolation, but rather as shorthand for 'individual affective *functioning* which may be autopoietically shared'. Conversely, even though sharing autopoietic functioning is a 'social' process in the sense that it involves more than one individual, I will limit the term 'social' to Luhmann's inter-personal communication process and the socially structured phenomena that emerge from communications.

I will elaborate on this functional differentiation of individual and social by following Luhmann's claim that both psyche (psychological functioning) and social systems process meaning. He makes this claim on the basis that both systems have a capacity for the second order cybernetic function of observation of a relation, in this case the boundary relations of the respective systems, a process that produces meaning. I will comment on its significance, firstly in individual functioning and then at a social level, in relation to forming groups and producing and using social phenomena.

7.4 MEANING FOR THE INDIVIDUAL AND CO-PRESENT GROUP

In complexity terms, the human mind can be understood as an emergent phenomenon of the complex system functioning of the individual body/brain in affectively-based relationship with other minds. These complex engagements produce individual consciousness, itself a complex system characterised by *embodied* relations, and experienced subjectively as being internal to the individual. If the individual mind is considered in this way, with these origins and connections, there are three interlinked issues that are relevant to any thinking about learning. These are:

- that individually the body/mind autopoietically processes meaning, so any event experienced by the individual is interpreted, that is, *meaning* is attributed to it, by the individual. This aspect of meaning is held in the individual's mind but is

constrained by the social and cultural contexts in which the individual functions and thus can be understood as a variation on the theme of the socially created meaning of the event.

- that the autopoietic nature of the mind's functioning means that it functions in the service of the individual's affective needs. Like any aspect of autopoietic functioning, it cannot be directed or controlled from without, nor by any deliberate action of the individual himself. Any directions given from without will be interpreted by the individual in terms of what meets his affective needs.

- that at the same time the individual mind is in communication with other minds, not only through conscious, social level, inter-personal exchanges, such as constitute Luhmann's communications, but also through sharing of affect via shared autopoietic functioning such that an individual is not necessarily always functioning affectively as an individual person, and the individual mind functions socially as if in some respects it is part of an affectively 'distributed' mind.

Meaning as a Basis for Autopoietic Functioning of the Mind

Dewey conceptualised the functioning of the individual organism in terms of its engagement in trans-actional relationships with its environment, such that changes in the environment are accompanied by changes internal to the organism which are the organism's moves to establish a new equilibrium for itself. (The process may be initiated by the organism, as for example the child's curiosity aroused by the sight of the flame, in Dewey's reflex arc paper (Dewey, 1896). For the human individual or the individual mind, the internal changes are experienced as the individual's interpretation of the experience being undergone: what meaning it has for the individual. The interpretation is shaped in part by what Dewey called 'habits'. These are the embodied pre-dispositions, developed over time by engagement with the environment, and so shaped by social and cultural experience, which influence an individual to make particular responses to changes in the environment (Garrison. 2001; Mousavi and Garrison, 2003). We can understand all engagement by the individual, with the external

world, as being interpreted on the basis of the individual's habits, an interpretation which provides the individual with a subjective and meaning-laden experience of a situation. This will always differ from another's experience of the 'same' situation; a particular event or piece of information will always have a somewhat different meaning for each different individual. This does not mean that interpretations are either a random selection or that they can be any possible interpretation. The mind is shaped in part both by the *biologically* based affordances and constraints that are held in common by the human body/brain, as there are limits to the varying ways in which the human brain is 'wired', and by the social and cultural aspects of the environment in which the specific individual has developed those embodied pre-dispositions or 'habits' that influence his or her interpretations. These individual pre-dispositions provide the internal information used by the mind in its self-directed autopoietic functioning.

Meaning and Affective Needs of the Individual

While affective function is poorly defined, it can be understood in terms of the complex relations of intra-psychic processing of experience from which the meaning that the individual makes of his or her experiences emerges. If we take the psychoanalytic idea that the human organism needs to manage internal affective states and does this by using the capacity to think, then how an individual will interpret a particular situation or experience and what meaning that particular situation or experience will have for him or her, will be shaped in part by the individual's affective needs. Affective functioning is basic to existence, it is the individual's part of the lived engagement with the world and is what drives, directs, and shapes individual functioning. Affective needs range from ensuring physical survival to engaging in creative activity; seeking the satisfaction of curiosity; the mastery of a meaningful activity; the management of anxiety or the maintenance of a relationship. Affective states are the driver for engagement with the world, and they provide both a sense of the self as an active agent, and the maintenance of the essential, basic on-going sense of being.

The individual's relations with the external world, which include both responding to aspects of the environment and seeking out engagement with the environment, are

shaped by and experienced through, affective states. Internal affective relations are largely outside conscious awareness. Any cognitive formulations, that is formulations embodied in conscious thought or language, that an individual may present as a rationale or explanation for an experience, come *after* the affective engagement with some aspect of the world that constitutes the experience. Even conscious awareness of intentions comes after the initiation of their biological correlates in the brain. So such cognitive formulations are not a representational account of a stable internal state in the individual's mind; nor are they the origin of human agency.

That experience is processed psychologically in the service of the individual's affective needs means that experience is always internally interpreted to produce an individual understanding. This is so even where the interpretive process involves affective engagement with others. It can be seen in the way that individual interpretations of the meaning of events vary. Even for the one individual, the meaning of a specific event may vary over time, changed by changes in the individual's affective state. Affective needs cannot be directed from without. So individuals decide for themselves, (in large part not consciously), how to relate to social system 'wishes': whether or not to obey road traffic rules, follow health advice, or learn material that a school curriculum presents to them. Social systems can appeal to individuals for compliance, or may punish non-compliance but they cannot direct the wishes, will or intentions of an individual. That power is a function of the individual mind's autopoietic functioning. However, while affective needs cannot be externally controlled, they can be influenced by those in whom we have an affective investment through the mechanisms of shared autopoietic functioning.

Shared Autopoiesis and the Individual

Although the autopoietic functioning of the mind means that the individual makes his or her own interpretation of experience, this interpretation is not made in social isolation. As described in the previous chapter, a feature of the autopoietic functioning of the human mind is the capacity to 'share' some aspects of that functioning. From the perspective of biology this is 'structural coupling' rather than autopoiesis. In biology,

structural coupling is a term for autopoietic functioning at an organismic rather than at a cellular level, and this terminology indicates the 'sharing' at a psychological level is accompanied by changes in biological as well as psychological functioning. However, I will continue to use the term 'shared autopoiesis' for this phenomenon.

From a psychoanalytic perspective, shared autopoiesis is understood as unconscious affective communication that contributes to the emergence of affectively based meaning of external events and of shared beliefs about the state of relations between the individuals involved. These include the form of 'what affective state belongs to whom', in a way that does not necessarily have to concord with the external reality of separate individuals. Technically these are described as unconscious phantasies (the 'ph' is to differentiate them from conscious 'daydream' fantasies), and are based on intra-psychic relational processes known by terms such as projection (a mechanism of disavowal), projective identification (where aspects of one's own functioning are seen as belonging to another), introjection and so on. A two-person sharing of affective aspects of autopoietic functioning, involving mother and infant, was described in Chapter 6, 'Complexity and the Psychological'. This process allows the infant access to another's mind while his own capacity to function psychologically is very limited and it does this by allowing him to affectively experience his mother's mind as his own. From an external perspective this is an illusion but it is an essential illusion that serves two purposes. One is related to survival, in that by being allowed to believe his mother's mind is his, he is provided with the containing experience of having a capacity to manage his affective states and of the continuity of relations and hence, of his very being. While seen from the outside as a relationship of two minds, it is jointly, although differentially, experienced as one mind, that can be used to 'think' the infant's thoughts for him, before he is able to do so for himself. The other purpose is a developmental function. Because his mother's capacity to think productively is a *relational* intra-psychic process, the illusion also facilitates the bio-psychological establishment of the relational basis of thinking in the infant, so he is able to move from the overwhelming state of only being able to experience, to one of being additionally able to *think about* experience. To be able to *think about* something requires the development of internal

distinctions in the mind which were described earlier in terms of discovery/creation of the distinction, between internal subjective experience and the external environment that can never be purely objectively known. In complexity terms, such distinctions can be seen to reflect increasing complexity in the mind of the developing individual.

This sharing of autopoietic functioning occurs between individuals all through life, although largely with less intensity. Sharing aspects of autopoietic functioning means that while the mind is *subjectively* experienced as co-terminal with the body, it can be observed, using a range of developmental psychology and psychoanalytic tools, to function socially as if it were in part a dynamically 'distributed' mind. This distributed functioning occurs on the basis of *specific* relations between individuals, known to each other 'by name' and usually develops out of at least initial face-to-face, intimate or adequately intense other forms of contact. Individuals bring this capacity for unconscious sharing of affective functioning to all encounters with other individuals, even to fleeting encounters. It forms the basis for the more conscious, and more widely socially shared language-based aspects of interaction between individuals. Repeated encounters between individuals allow a knowing of the specific other and the development of affective bonds with them so that relationships can be maintained in the mind when the other person is absent. Once established between specific individuals these bonds do not wholly depend on continuing face-to-face contact, but lack of contact can allow the affective connections to fade over time. Affective functioning is *the* truly bio-psycho-social phenomenon. It does not reflect an integration of initially separate phenomena from those domains; it can be understood as *emerging from* multi-level complex relations involving all those domains. Affective states have their origins in the interaction of the individual's biological and social experiences; they are emergent from biological function and have somatic concomitants, while their meaning has been derived from the social relationship between individual and others, but such meaning, as emergent from these relations, is novel and unique.

Shared Autopoiesis and the Co-present Group

Shared autopoiesis has significance in the functioning of human groups where the group is based in some form of specific individual contact, known as 'co-presence'. Because such groups are based on contact between specific individuals, they are necessarily limited in size and they differ functionally from larger groups which constitute crowds. It is the shared affective aspects of autopoiesis that provide group members with the feeling of being part of a group rather than a collection of individuals. This sharing also allows for a 'division of emotional labour' where group members may have a specific affective role attributed to them by the group which then treats them accordingly. These may be roles such as that of 'wise leader', 'class clown', 'newcomer as unwanted intruder' or 'idealised couple who exclude others'. These roles where an individual (or sub-group) functions as a container for an aspect of group affect may be brief or lasting. The affective state may be experienced very intensely by the individual to whom the group has allocated a particular role and who may not understand that their function is to 'hold' a particular affect for the whole group. How affects are managed within the group contributes to the group's capacity to function in managing its social level function of the formally nominated work or purpose of the group, such as solving a problem, performing a task or accomplishing some learning. This work function is done by the group decision making, which can be understood as the producing and processing of communications as described by Luhmann, but this can only be done if it is not overwhelmed by the group's other function of processing affect.

This sharing of autopoietic functioning in relation to affect means that a co-present group contains autopoietically functioning individual minds and itself functions in part as an 'affectively distributed mind'. At the same time the processing of the inter-personal selections in relation to information (Luhmann's communication process) functions as the origin of social phenomena. It can be seen that the one activity, that of individuals interacting in a co-present group, has two functional outcomes. The experience of engagement changes the bio-psychological functioning of the participating individual, a change that can be understood as learning in its broadest sense. The same engagement, because it involves more than one individual, functions as

the inter-personal relational platform from which social phenomena emerge. The co-present group is the site both of individual affect-based learning and of the production of communication-based social knowledge. Before considering this further I will elaborate on how meaning in the social domain can be understood.

7.5 SOCIAL ASPECTS OF MEANING

Thoughts, as a product of thinking, have both an internal psycho-biological function in managing affect and an inter-personal communicative function. This dual function is reflected in the original condition of mother-infant communication which is used for processing the affective states experienced by the infant. When thoughts, with their affective entailments, are expressed inter-personally, they provide the basis for the co-production of social meaning. Luhmann described what he called interaction systems based on face-to-face co-presence (Luhmann, 1995: 412-422), referred to in Chapter 5, 'Complexity and the Social'. The communication function of these systems is the process of iterative selections made in co-present groups, progressively reducing complexity to produce what forms the basic functional 'material' of all future social phenomena. The 'meaning' of Luhmann's communication process does not belong to the individual mind, because communications are not a product of the *bio-psychological* functioning of the individual but are the product of complex *inter-personal* relations *between* bio-psychologically functioning minds. However, because of their co-presence, these inter-personal relations are not reduced or abstract relations: they have a component of shared affective functioning which is the source of meaning that the outcome of the communicative process will carry.

As individuals, people interpret social meaning in the service of their own affective needs, through their biologically based pre-dispositions or Deweyan habits, and in the context of the changing social environments in which they find themselves. They use these individual interpretations in their interactions with others. Individual interpretations feed into the contingent selections of the communication process contributing to the adaption, elaboration, and editing of meaning. The social aspect of meaning, or knowledge, is always evolving as a result of being used and re-used in

multiple communicative acts, in multiple contexts. So, the form of a musical performance of the one score will differ on each occasion that it is performed, which in turn will influence other local performances; when guidelines are used, they are invariably adapted to local circumstances; Bereiter's conceptual artefacts are necessarily adapted where they are translated into material artefacts; what constitutes the knowledge of a community of practice continually evolves; and intellectual paradigms are replaced with newly emergent paradigms when insoluble problems mean that a new paradigm offers more promise (Kuhn, 1970:157-158).

This means that from a complexity perspective the issue of whether meaning is an individual process or a social process itself becomes meaningless. Meaning is socially produced but because it is produced by a complex system of relations between two (or more) complex systems, it resists being fully determinate. Its relationally reduced social aspect is 'embodied' in the various ways described, while multiple, individual but constrained, interpretations that are the 'variations on a theme' of a living complex system, are the on-going source of its evolution.

Meaning and the Production of Social Phenomena

While the social aspect of meaning, or knowledge, is non-material, it has its origins in the complexity-reducing moves between individuals in communicative acts, so it is also relationally reduced. It is experienced by the individual as something external to the mind and so may have something of the experiential quality of being an entity or object. It may be wholly abstract and accessible to the individual for use, such as community ideas or concepts, languages or bodies of knowledge. Or, it may have been developed into the larger and more complex social structures of society, such as institutions and organizations. Social phenomena may have varying degrees of expression in material concreteness, such as the way that artistic creations or performances may have material expression, or the materiality of Bereiter's 'conceptual artefacts' of guidelines, plans, models or texts, or the material entities used physically that have meaning attributed to them and are commonly designated as tools, such as digging sticks or a cooking fire. Despite the varying extent to which materiality is significant, what social phenomena

have in common is their *functional* capacity for carrying meaning at a social level, for functioning as an expression of it or making it available for use. However, the origins of social phenomena, as instances of communication, are fragile. Their continued existence depends on their collective use at a social level and lack of use leads to their disappearance.

Social meaning may be too *complicated* for an individual to comprehend, as say a body of mathematical knowledge may be, but it is less *complex* than human thought. This is why, for example, that however detailed a protocol is, it cannot simply 'be applied' to manage a problem situation. It is the generative or creative capacity of symbolic human thought, based as it is in complex functioning of the individual/co-present group mind that manages the problem. Even where management of a problem involves the use of say, a protocol as a tool, interpreting the meaning of the protocol, in light of the immediate context, is an activity of human minds. The communicative function of co-present groups produces relationally reduced but fleeting communications from which, with use and elaboration, social artefacts and structures may evolve that have a greater durability in time and reliability across contexts. So, a practice guideline has some stability in that it can be replicated and transported between contexts but that stability depends on reduced complexity. The guideline always needs to be re-interpreted on the basis of the new context in which it is to be used, again via communication processes. This re-introduces complexity but again reduces stability. An organization has some stability over time as a result of the constraints and affordances of its historically shaped purpose, which are expressed in the present in the ways in which decision-making by the organisation's personnel is constrained by their organisational function. Institutions such as the law, the church, the economy, or nation states have a durability measured in hundreds of years and an even greater stability.

Meaning and Social Systems

Social systems can be understood as being an expression or enactment of social meaning or as carriers of social knowledge, emerging, in Luhmann's understanding, from the multiple communications of society as a whole, in the form of different types

of systems: institutions, organisations or interactions. In Luhmann's work, society with its derived systems is elaborated on, as a whole. My interest in learning is focused on the interface between the individual/psychological functioning and the co-present group which is the site for processing of meaning for individual learning and for the production of knowledge, and so only on a part of the system as a whole. Co-present group functioning produces the communications which constitute the 'material' of society as a whole. These in turn are made available, through society's organisations, for use at an inter-personal level in co-present groups where they may be elaborated on in further interactions, contributing bottom-up to shaping the functioning of developing systems and producing relevant social artefacts for use in the process. (Consideration of top-down sources of constraints and affordances in the emergence of social systems is beyond the scope of this thesis.)

Maintenance of a social system's existence lies in the on-going activity of its processes. These are based in the continued interpretation and re-interpretation of the system's meaning and functioning by the individual personnel of the system. However these individual interpretations do not contribute directly to the system. It is the inter-actions between individuals *about* these individual interpretations that form the communicative process that constitutes the system's functioning. Communications are constrained by the purposes or meaning of the system which acts as the attractor of the system. But at the same time, because of changes within individuals over time, and changes of personnel in the system, different interpretations of the system's meaning or purpose and modes of functioning are brought to the inter-personal interactions over time. This means that communicative processes continually produce the evolution of an organisation's internal culture.

Because they function autopoietically, social structures such as organisations are functionally inaccessible to any one individual or to any co-present group not produced or 'allowed' by the organisation itself. The influence of one individual or co-present group, even when accorded organisational decision-making power, is constrained, and to deliberately influence the functioning of structures with such inertial momentum, involves widespread change (Mason, 2008). Individuals and co-present groups *can* only

change aspects of social systems by participation in the interactions of the system, and it is in this necessarily constrained participation that social systems can be said to 'live'.

7.6 LEARNING FROM A COMPLEXITY PERSPECTIVE

The focus of this thesis is on how learning in relation to practice can be conceptualised. Even though, as pointed out above, complexity is known experientially by individuals, its significance is commonly overlooked in relation to education or learning, as illustrated by the thinking that underlies traditional models of learning and practice and the debates about whether theories of learning based on individual functioning and those based on sociocultural functioning can be reconciled, and if so, how.

Learning Conceptualised from a Complexity Perspective

In this thesis I have drawn on several already current theories and bodies of concepts which are consistent with a complexity perspective, to support the use of complexity as a framework in re-formulating learning and its relation to practice. The first of these is Dewey's formulation of living functionality which has trans-actional relations as a central feature. The second is a body of concepts derived from psychoanalytic thinking and other theories of psycho-biological functioning which relate to affective function, where experience is affectively shared and processed to produce meaning, and where affective needs act as a driver of human processes and activities. What these concepts have in common is an understanding of human psycho-social function as having a relational basis at multiple levels, for which trans-actional relating can function as a model. These two bodies of concepts, with Luhmann's theories of social functioning as emerging from inter-personal communication, allow for distinctions to be made between aspects of human functioning at biological, psychological and social levels, which in turn allows a re-formulation of learning, its relation to practice and the production of knowledge.

Learning is traditionally understood in terms of the alternatives of being based on a mind co-terminal with the individual body or the individual somehow absorbing something through immersion in a learning context. However, formulating learning as a

complex system means making a shift from the substantialist perspective of the bodily-based individual, who experiences life subjectively and is socially defined as an individual, to considering the functionally-based psychological aspect of the individual that is not co-terminal with the physical body, and may be shared in co-present groups. It also means that there is a differentiation between individual *understanding or knowing* which is a bio-psychological function and experienced as bodily-based subjectivity, and the social aspect of meaning, carried by social phenomena such as social and cultural processes, institutions and systems, which is emergent from social interaction and is conceptualised as 'knowledge'. Thus conceptualising learning in complexity terms means that an alternative formulation of learning as both individual and socio-cultural processes, where both are linked but irreducible, is possible. I will now expand on what this means, firstly for individual learning and then for the production of social knowledge.

Individual Understanding or Learning from Experience

Human affective functioning encompasses both the impetus of the individual to engage with some aspect of the world and the individual's response to any such engagement in a way consistent with Dewey's understanding of life for the individual organism as an on-going trans-actional engagement with the environment. Processing the experience of trans-actional engagements changes the individual. The need for this processing of experience can be understood as initially being for immediate affective management in order to re-establish a (temporary) equilibrium for the individual. Because the mind encompasses biological and psychological functioning, the process of engagement with the world and the processing of that experience, involves the mind at both of these levels. In part because of the mind's biological concomitants, the processing results in the modulation of the individual's capacity to respond in similar future engagements and thus it also modulates the way in which the meaning for the individual of previous similar experience is newly re-interpreted psychologically. Memory is not an unchanging entity of representations stored in the brain but a meaning-generating process of brain/mind function, which is constantly revised in the light of new experience.

These changes in brain/mind can be conceptualised as learning from experience in its very broadest sense. The individual, with affective connections with a unique pattern of multiple co-present groups, processes experience in the mind attributing meaning to it, and converting raw experience into understanding. This understanding or what has been 'learned from experience', largely remains out of conscious awareness as 'tacit knowledge', aspects of which may emerge into conscious awareness when called upon. As the philosopher Charles Taylor puts it: 'We do frame representations…but much of our intelligent action in the world, sensitive as it usually is to our situation and goals, is carried on unformulated' (Charles Taylor, 1995b). Understanding is ostensive, in that it appears only when it is 'called forth' as an emergent feature of a live engagement with the world. 'We only know what we know *when* we need to know it' as Sturmberg and Martin state (2008; italics added). When the situation in which individuals use understanding is in any way enacted in terms of a practice, the learning is described as experiential knowledge or 'know how' (Beckett and Hager, 2002: 5).

Learning from the Experience of Practice

Learning formulated in this way is inseparable from practice, where practice is understood as the active trans-actional engagement of the individual with aspects of the environment. Practice has the Greek root 'praktikos' which means 'fit for action' (Chambers 1983). It is 'to act, to perform, to actually do, to do habitually, to exercise one-self in, or on, in order to acquire or maintain, a skill'. There are two aspects of this definition to consider. One is that practice derives its meaning from its relations. One don't just practise, one practises something. Even in intransitive form, as in 'He practises in Smith St.' there is an implied object of practice. To say: 'He practises' is meaningless because as a concept practice is always in relation to something. The concept of 'practice', like that of 'context', cannot be independently defined. 'There is nothing general beyond or behind practice that explains it' (Turner, 2007). (I agree with Turner's statement, although he takes this as evidence that there is a problem with the very concept of 'practice'.)

The other aspect of the definition of practice is to do with learning. One of the everyday usages of the term relates to doing something in order to know how to do it in future: 'He is at footy practice' or 'I'm not practised at doing this yet'. Further, the root 'praktikos' meaning 'fit for action' contains the sense of a future-directed focus or potential; of practice as a capacity, a having or knowing something, in preparation for use as needed. This suggests that practice and learning are intimately linked and that knowing how to do something or 'being practiced' is as much about being able to do something when called on, as it is about the literal 'doing' itself. Hence 'The person of real practical wisdom is less marked by the ability to formulate rules than by knowing how to act in each particular situation' (Charles Taylor, 1995b).

Aspects of what has been understood or learned from experience can be formulated as thoughts in the individual mind. This can make sense only if the production of meaningful thought is understood not in individualistic terms, but as the mind structured in the body/brain but functioning as an aspect of co-present group function. The individual has already learned in his early relationships that meaning emerges from external relational processes and structural coupling has allowed him to internalise the relational nature of thinking quite literally in biological form. So, in thinking, the individual is using multiple affective connections with members of his or her community even in their literal absence to access the community's social and cultural knowledge.

Learning as Affect-driven

Conceptualising the individual as affect-driven has consequences for how formal learning situations such as learning in a classroom or learning for work practice, are understood. It suggests that the learning process will be shaped in part by the individual's affective needs, which are never fully conscious. Whether the need is for a live emotional connection in the moment, with a specific other such as a teacher, or the need to feel part of a group; the need to satisfy curiosity or to avoid the anxiety of not knowing; or the need to master information for use as a tool for some further purpose, it is the individual's need that directs what any learning experience will come to mean for

that individual and, therefore, if and how any learning happens. Individual learning cannot be driven by the unmediated wishes of others, despite that being a common assumption which is often expressed through the requirements social organisations have of individuals.

This means that when material is presented with an expectation that it will be learned, as is common in formal learning situations such as a class, then what is learned does not come about by the linear transfer of 'knowledge as a substance or entity' as assumed in the body of literature on 'knowledge transfer' (see for example Davis, 2006; Graham et al, 2006). What is learned is always what emerges from the individual's autopoietic interpretation of what is presented. The interpretation made reflects the individual's immediate affective needs, based in his or her pre-dispositions and by the meaning that the context of the presentation has for the individual, such as the role they may be playing in a co-present group. As everyone knows from experience, you can't learn if you feel intensely anxious, angry or shamed. Nor can you learn if you understand your role in the class or in the family is that of 'the dumb one'. Learning involves the affective processing of the whole of the engagement within which any learning is expected to occur.

As we have seen in relation to early infantile experience, the infant learns from his mother what something specific means in his social or cultural environment, but he also learns that this involves 'thinking about' it. In using his inter-personal trans-actional relations with her he internalises a relational function of her mind which he can use to do his own 'thinking about' in order to discover/create his own interpretation of that meaning. This means that *what* the individual learns is not an entity or 'thing' but *a relation*. This can be seen as Malpas' 'object of presentation'/context relation whereby an object comes into view with a related context which gives the object its specifically situated meaning. The individual learns of this relation through participation in a series of relations, internal to the mind and external with the environment. Learning always involves something of the trans-actional relations of the engagement that the individual has with the learning situation, a relation of which he or she is a part. Whether the situation is an informal experience of life, the pursuit of an interest, the experiential

learning of an apprenticeship or of professional practice or a classroom situation where the engagement may include material 'to be learned', *what* is learned by the individual is a *learning about* the material or social entity being presented and the context within which it is presented/discovered. Thus for the individual, learning about material that is presented 'to be learned' means knowing it in context and in a way that is shaped by the individual's relationship with it, which is what gives it its personalised qualities and the individual's subjective sense of ownership of it. Knowing or understanding can be described as an experience of a relationship, in contrast with 'knowledge', which is more reduced and abstracted from bodily connections and which functions as a social phenomenon, to be used through re-interpretation as a mechanism to some affective end.

The Co-present Group and Learning

Multiple human activities take place in small co-present groups, including couples, where interaction over adequate time allows the formation of affective bonds so that individuals are known to one another as specific individuals. The attractor of such groups is the group's self-directed meaning or the group's interpretation of its own core function. In formal learning situations such as classrooms, tutorials or apprenticeships, the attractor is the formal learning purpose, because that is what group participants understand it to be. In the family, it is the provision of emotional and material support for members and rearing of a new generation. For a small team or a working party, it may be the completion of a task; for a brainstorming session in an organisation it may be the emergence of new ideas. Where a professional seeks a second opinion from a peer, a temporary two-person co-present group is formed, the purpose of which is some aspect of the management of the professional's problem.

Because co-present groups commonly involve face-to-face or some other form of direct communication between members, communication is not limited to exchanges of information. Non-verbal aspects of communication such as body language, facial expression and vocal intonation facilitate the tacit sharing of beliefs or understandings which form the basis of the 'distributed' affective functioning that characterises such

groups. This aspect of the group's functioning is to manage emotional aspects of the group's work or purpose. Much human work, including learning, is disturbing in some form. It may evoke curiosity, interest or excitement; it may be painful, anxiety-provoking, or shocking. Here the group's capacity to function as a 'distributed' mind allows it to 'metabolise' the affect in a way that can be experienced as containing for the individuals involved, just as the infant's experience of his mother's thinking capacity is felt to be containing. This affective processing is essential for the group, not only so that it can address any overt work purpose and come to a shared meaning of the work, but also because it is a necessary aspect of establishing and maintaining the group as a group.

Where there is something that needs management by being thought about, particularly anything difficult or disturbing, management by the distributed functioning of a small group will be more functional than management by the individual alone. A human group that is small enough to be formed by affective bonds has greater complexity than either an organisation from which it may be derived or an individual mind alone and hence a better functional capacity with which to meet the complexity of many work or life situations.

As described above, co-present groups are generative in two distinct ways that are functionally individual and social respectively: the central function of processing of affect results both in individual learning and in the production or adaptation of knowledge for social use. One way of understanding these two linked but differing processes is to understand them as belonging to the micro and macro level functioning respectively, of the complex system constituted by a co-present group. The micro level of co-present group functioning is formed by relations involved in the processing of the affective material; the intentions, wishes, understandings, etc. in relation to the group's purposes, brought to the group by participants. Participating individuals are changed in the process of participation in these relations, as participants to Deweyan trans-actions are changed. Because they are themselves complex systems, 'changed in the process' means change constrained by the individual's own autopoietic functioning, change which can be described for the individual as learning from experience. How each

individual in a co-present group changes and therefore 'what' each individual learns will differ under the constraints of individual autopoietic as well as that of the group functioning. Because complex functionality is not determinate, each individually interpreted experience of the group processes is one of the variations of the meaning of the group attractor.

The second generative process of co-present group functioning is seen in the emergence, at a macro level of co-present group function, of less complex communications, which have the potential, with continued use, to become more structured and more lasting social phenomena. This conceptualisation means that knowledge can be understood as a social function, and one that depends for its production and continued existence, like all social phenomena, on its ongoing use by individuals/co-present groups. This use involves the interpretation and re-interpretation of the knowledge *by* individuals, fed back into communicative processes *between* individuals. Because such individual and group usage is always contextualised, the use of knowledge adapts it to local circumstances and in this way constantly changes it so that it is seen as evolving. Knowing is not the individual possession of such knowledge. Knowledge cannot be individually possessed because it is a social phenomenon, and as such is experienced as an entity, external to the individual. Rather, knowing is the intra-psychic processing, individually or in a group, of experience which includes the interpreting and re-interpreting of knowledge in order to *know about* it.

The Co-present Group and Knowledge Production

In the traditional conceptualisation of learning, learning is understood to involve the provision of formal knowledge to a learner who is to take it in, through the involvement of a teacher who is thought to have earlier undergone a similar process and therefore has knowledge to be passed on. The formal knowledge that is to be 'learned' is often the result of research, or the content of a curriculum, and is ultimately understood as a possession of a social organisation such as an education department or a community of practice. I have argued that learning, for the individual, can be understood as an emergent feature, based on an individual's engagement in practice or learning activities

and the interpretation by the individual of the meaning of the experience, interpretation contextualised by the interpersonal process of co-present groups. The production of knowledge, on the other hand, can be understood as emergent from complexity-reducing aspects of co-present group functioning. This happens where the work of the group can be formalised as the production, development or adapting of some form of social knowledge. This process is described by Bereiter as 'knowledge building' and an example is a professional group working to produce a practice guideline. But it also happens when the overt purpose of the group is the use of its co-present functioning to manage a specific, immediate and localised problem, such as is the stuff of much of life's practices. Here, the *use* of social knowledge as a tool of practice results in its development or evolution as an additional, not necessarily intended, outcome of group functioning. When I discuss a clinical problem in the co-present group of my Peer Review Group (Balla et al., 1996), my intention and that of the group, is to discover new ways of thinking about my problem such that alternative perspectives on it, that I had not been able to think of, become possibilities. The intention of the group is not to contribute to the adaption or modification of the professional knowledge that we may use as a tool in this process. However, as our new interpretations of such knowledge are taken from the group and used, tested out and adapted again, elsewhere in the professional community, this is necessarily an outcome of our actions. In this context the production of knowledge is a side-effect of learning processes.

Relations between the Individual/Co-present Group and the Organisation

Differentiating between learning and the production of knowledge in this way involves attributing them to different forms of functioning in the complex system of a co-present group. However, considering the production and use of knowledge raises the need to consider co-present groups in relation to the larger social structures within which they function. Some of these, Luhmann's organisations, such as businesses, schools, education departments, professional bodies or communities of practice groups, produce co-present groups such as apprenticeship dyads, classes, tutorials, supervision groups, committees and work groups, as part of their functioning. This comes about because, as previously described, such groups have a greater complexity than is available to the

organisation as a whole entity. The way in which organisations manage complex tasks is to create internal co-present groups to which such tasks can be delegated. This allows the organisation to deal with more complex situations that it in its entirety, could. Organisations provide the social framework within which such sub-specialised groups function and act as part of the groups' environment, constraining and facilitating the groups' functioning. However, there is a functional distinction between the organisation and the individual mind/co-present groups functioning within it. They are mutually dependent but differing types of systems, and driven by different autopoietic functioning. Co-present groups are based in the bio-psychological functioning of human interpersonal relating. Organisations are based in the more reduced, overtly social aspects of interactions about the organisation's purposes, rules, resources etc.

Organisational power and responsibility may be vested in one co-present group, say a managerial group, while other co-present groups are delegated to implement processes or solve problems. So, for example, many 'top down' programs which are known at the grass roots level of the individual practitioners or small groups to be likely to be ineffectual, can still be implemented at organisational level insistence. Examples are a requirement that only programs conforming to 'evidence-based practice' in medicine will be funded, or a top down direction that a nationally uniform assessment program, intended to lead to improvement of literacy and numeracy in education, is to be implemented. In this situation the practitioners who have the more complex task of implementing these programs will often know either that the program is going to fail in terms of its stated aims or that it will have outcomes for the organisation unforeseen by the management group.

An organisation and its co-present sub-groups are mutually dependent. The organisation needs complex tasks managed and organisational dependence on co-present groups is reflected in their production, in the provision of resources for them and in the degree to which they are allowed their autonomous autopoietic functioning. A co-present group's dependence is embodied in the constraints under which it works which originate with the 'parent' organisation, such as its organisational purpose. While autonomous functioning of such a co-present group may be the only mechanism whereby certain

processes can occur, it is organisational decisions that determine both what its purpose should be, and whether or how the outcomes or products of its functioning will be used. Many committees produce reports for organisations that are not published or acted on, as the power to make such decisions belongs elsewhere in the organisation.

There is a tension between the way in which an organisation's co-present groups are conceived in the traditional substantialist framework and how they look from a complexity perspective. In the former, such groups are understood as being fully open sub-groups of the system, with their internal functioning as an extension of that of the system, leaving them dependent on the system, not only for their existence but for the direction and management of their internal functioning: not only *what* they are to do but also *how* they are to do it. This is the commonly held view of how organisations function and it is often shared by managerial or executive groups or branches within organisations. A complexity perspective re-conceptualises internal co-present groups as autopoietically functioning sub-groups of the organisation which offer the benefit of the increased complexity of a co-present groups for organisational purposes. However, because such groups function autopoietically, this comes at the cost to the organisation of ceding control of the group's functional processes, that is, the *functioning* internal to the group that is an expression of its autopoiesis. The organisation can delegate work for the group to process, such as a problem-situation that needs resolving, but to be effective, there has to be an acknowledgement that the processing of the problem is a function of the group's autopoietic functioning, and is directed by the group itself. So, an organisation can ask *for* a problem to be addressed, can set limits about what *cannot* be done by the group and will need to provide resources for the process, but it cannot prescribe *how* the problem is to be addressed. Attempting to do so constitutes an intrusion on the group's functionality. Intruding fully into such a group destroys its functioning, as there is then no functional boundary between the sub-group and the organisation as a whole. In losing its existence as a functionally differentiated sub-group, it loses the increased complexity that it has to offer the organisation.

Organisational Learning

Understanding the differences between individuals (and co-present groups) and social organisations and the relations between them as described above, suggests that there are two ways in which the term 'learning' can be understood in relation to organisations. In this thesis I have limited the use of the term 'learning' to processes of the mind (albeit one that involves other minds). So, a literal understanding of organisational learning involves the learning that individuals within the organisation do. This may be deliberate learning, for example becoming familiar with organizational knowledge or pursuing some aspect of a community of practice's body of knowledge. Or, it may be learning that results from the processing of their experiences of their work, individually and in co-present groups. This learning is accessible to the organisation in that it will be used in the on-going interactions that refine and adapt the organisational knowledge such as plans, structure of networks, decision-making processes etc. that constitute the organisation. This use, in turn, contributes to what can be understood as a second form of social level 'organisational learning'. This is the evolving change in the internal structure of the organisation brought about by its internal processes: the increase in its internal complexity as a result of its self-organisation processes, contributed to by both individual/co-present groups within the organisation and by the organisation's experiences with its external environment.

Learning as Complexity Functioning

The above differentiation of individual and social aspects of learning can only be formulated within a function-based framework of inquiry. A substantialist framework gives us humans as individual entities, limits relations to Deweyan inter-actions and makes systems either a collection of individuals or, via deterministic complexity, a complex but deterministic system of generic individuals. A general complexity or complex relation-based framework in contrast, allows function to be addressed. While function is commonly equated with structure, a complexity perspective illustrates how functional systems do not necessarily share boundaries with the substantialist, entity-based structures associated with them. Thus, the human mind is both subjectively experienced as being internal to the individual and is commonly seen as limited to the

individual body, but in co-present groups, through the sharing of autopoietic functioning, it is also party to the distributed 'mind' of the group. In turn, social phenomena, which take the form of concepts, bodies of knowledge, co-present groups and organisations, etc., emerge from social interactions *between* individuals. They are closed to the individual mind in that they can only be accessed by the individual through participation in a communicative process, a social, not an individual, activity. It is one of human interactions, constrained by the wider social context. As experienced by the subjectively experiencing individual, who may participate in, but cannot know the whole of their internal processes, these social phenomena appear to have substance. Perhaps this is why such phenomena are given the term 'structure' (Sibeon, 1999) in sociological thinking. However, such experience is the individual's subjective experience of exclusion and powerlessness *as an individual* in relation to social phenomena. It does not reflect an apprehension of some external reality. Social phenomena themselves, however extensive their existence in space-time and however socially powerful they are, can be seen to exist only in their functioning and when that ceases, so do they.

7.7 USING COMPLEXITY FOR LEARNING

The Experience of Complexity

As a field of theories, complexity is new. However, its use does not involve the consideration of something that feels new but rather of something already known and accepted, albeit tacitly, about human functioning. Even with the substantialist formulations and models of how the world works, we know experientially about life as complexity. However, despite individual experience, little of what is known experientially of complexity is formulated either conceptually for use in theory development or in public discourse. This relative ignoring of complexity may be because social level functioning itself is a reductive move from experiential life, as individual experience is reduced in complexity for the purposes of communication and decision making. Further, communication involves interactions *about* reductively formulated activities, tasks or work, such as planning activities; producing timetables

and guidelines; formulating policies; developing processes, etc. Because of the reductionism inherent in both the process and content of such activities, awareness of complexity itself can disappear. Reduction is important at the level of individual functioning, as well. We rely on models of how the world works in part because many of them are functionally helpful, but also because they offer the reassuring experience of certainty, perhaps a reason why models are often so easily taken for the reality that they only represent. In contrast, the complexity of lived life is emotionally disturbing because at the heart of complexity there is always something unknown: the reality of indeterminacy, with its capacity to bring destruction as well as creation and '…human kind cannot bear very much reality' (Eliot, 1944).

That complexity is relatively overlooked in the theorising of social functioning results in a general failure to consider uncertainty as a source of generativity as well as of risk. At a social level awareness of complexity is often formulated in terms of failure, as in the 'failure to come in on budget and on time' and as in the pervasive view in medicine that an unplanned outcome represents error. Even where complexity presents something that is experienced as new and useful, its origins may be stripped of context and it may be put down to 'just' chance or serendipity because it was not a humanly directed or controlled process. So for example, we are taught that in observing a culture plate after an absence from his laboratory, Alexander Fleming discovered penicillin *by accident*, rather than that, because of his previous experience, Fleming recognised a new significance in what he saw in the culture plate. So, although complexity is *experientially* familiar, to use it as a basis for formulations and models of the world does involve taking a radically new *theoretical* perspective on human functioning. For example, the arguments that learning in some form emerges from all experience of engagement with some aspect of the world or that the psychological processing of experience of such engagement produces learning in the individual, reflect a radically different model of learning from a formulation that learning involves taking into the mind pre-formulated entities, known as knowledge, with meaning inherent in them. However, because we already have an experiential grasp of complexity, the former proposition is intelligible.

I will finish this chapter with some brief comments that illustrate the sorts of issues that the use of a complexity perspective raises for the practical consideration of learning.

The Practical Significance of a Complexity Perspective for Learning

Some general comments can be made about what needs to be kept in mind when using a complexity perspective in thinking about social systems, including those systems involved with learning. These comments relate to the significance of indeterminacy for generativity; to complexity reduction as a process which is therefore available to function as a tool, the use of which brings epistemological losses as well as gains; and to the need for complex systems thinking in relation to learning systems.

Indeterminacy: Not-knowing, Generativity and Error

Complexity re-introduces the indeterminacy that has been reductively removed in substantialist accounts of the world. To use a complexity perspective in relation to practice and learning means acknowledging indeterminacy, the human experience of which is uncertainty or 'not knowing'. Traditional models of learning rarely conceptualise human uncertainty as a necessary and useful 'space'. They focus on the removal of 'not knowing', commonly filling any 'not known' space, if necessary with generalised knowledge, like theory or the knowledge contained in a guideline or protocol. To acknowledge uncertainty means taking a 'modest' position in relation to what can be known which could be interpreted as weakness (Cilliers, 2005b), in contrast with the promised certainties of a substantialist perspective. However, while reduction of complexity is a tool by which human complex systems come into existence and maintain themselves, their generativity emerges from the indeterminacy which is a defining feature of complexity. Unless 'not known' is given space, in the mind of the individual or the structure of the learning situation, nothing qualitatively new can be discovered/created. The cost of using a substantialist perspective is that it forecloses on generativity. From a substantialist perspective generativity cannot be accounted for theoretically and if models developed within this perspective, such as an Evidence-based Medicine model of practice, were able to actually be put into practice they would

consist only of arrangements and re-arrangements of what is already known, and would not produce anything creatively new.

Thus, acknowledging indeterminacy means expecting uncertainty and understanding its relation to generativity as well as to error. For any human activity, there will be variations in expected outcomes and the emergence of unintended outcomes which may include creative novelty, or may be already defined by a community of practice, or determined by retrospective review, to be error. Expectations of a learning situation need to be conceptualised as including an uncertain 'space' from which new understandings for the individual or new group knowledge may emerge. Such 'space' includes the recognition that even required or predicted learning outcomes will still necessarily be uncertain. Learning outcomes may only be realised as they emerge at a later time or in another related context, and they will never fully cast off their indeterminate origins and will always remain defeasible. Thus, everyone, including the teacher or mentor, will go into a learning situation with some uncertainty about what outcomes there will be or when such outcomes might manifest themselves. So, exit questionnaires of the 'What have you learned from this seminar?' kind that often follow formal learning activities can be seen to be of very limited value.

Complexity Reduction as a Tool

A complexity perspective requires an understanding of relational reduction as previously described, as a mechanism that has two separate but linked functions. It is used by individuals as part of the management of internal affective states, which include the management of the anxiety induced by uncertain external circumstances. The human capacity to function rests on this. No-one can think or act productively while in a state of existential panic, and management of the anxiety of life experiences, although it occurs largely outside conscious awareness, can be understood as a developmental achievement for the individual. At a social level of functioning, relational reduction is also a necessary aspect of the social processes of human communication and inquiry, of human interaction with others and in the production and use of social tools.

Complex social systems emerge into existence through a reduction of complexity which makes system functioning possible. Their functioning over time is modified by the human activity in the system involving continual interpretation and re-interpretation of the meaning in the system and decision-making in the service of its function, which variously increases and reduces complexity in the system. The extent of complexity in any learning system, while continually changing, reflects a balance. While reduction of complexity in the system is necessary so that it can function in a practical way, there is also a need for enough complexity to be available in the system for individuals to use it for the creative and adaptive processes of discovery that reflect the system's functioning.

For an individual, engaging in communicative processes in order to attribute meaning to a specific situation or as part of producing a decision requires thinking. But thinking about a specific situation is a process that brings an awareness of its anxiety-provoking aspects for the individual, and the psychological processing of this takes time. Time for human thinking is socially expensive so both the human need for affect management and the necessity for human processes in doing this, are often ignored. There are common situations in human service systems, such as education or health systems, where a standardised form of decision-making in the form of pre-prepared tools such as protocols or guidelines, is presented as efficiency even though their use may come at a human cost and ultimately at the cost of efficacy. So, for example, for e-learning to be effective in situations where face-to-face contact is not possible, allowance needs to be made for the increased difficulty in forming the co-present groups, essential to learning, that comes with such a mode of learning.

Systems Thinking in Relation to Learning

The co-present groups which form the site of learning in any system are complex systems themselves, and are productive in terms of emergence in two different ways: learning for the participant individuals and production and modification of social knowledge. These two cannot be separated but the co-present group's purpose or meaning will determine which aspect is relevant as the work function of the group. So, I

learn from my work practice, although the purpose of that practice is that particular work be done, not specifically that I should learn. In contrast, when I present a work problem to my Peer Review Group, the purpose is that I should learn.

The traditional understanding of the small groups such as learning programs, classes or seminars, in which learning takes place, is as described above, that they are functionally continuous with the organisation, institution or society as a whole, which has given rise to them, because the relevant relations, internal to the 'parent' body and learning system alike, are understood to be Newtonian relations. With this conceptualisation, the internal processes of the small group are treated as if they can be fully and transparently delineated and the 'parent' body can direct the internal functioning such that its own desired outcomes will follow. A complexity perspective however, suggests otherwise. Learning programs based on co-present group function are not *functionally* continuous with the social system that is their 'parent' organisation. This is because co-present systems are based on complex internal relations that allow the processing of affect and the attribution of meaning and so differ from the reduced relations of the organisation as a whole.

This situation means that consideration needs to be given to the co-present system and the 'parent' social system individually and to the relationship between the two. What needs to be thought about relates to what circumstances may be associated with emergence for a particular system. Questions could be considered in relation to a co-present group's functioning such as: What might constitute the micro level of a complex system from which some (range of) possible results are wanted? Who would be party to the central relations of the micro level of the system on which system functioning rests, that is, who would be *in* the co-present system? What is the attractor or attractors, that is, the self-referential meaning of the system, its 'purpose', and what might be the limits in terms of expectations of this system? What raw materials might this system need in its functioning and what support might be required by or offered to it, to foster its functioning? How can the boundaries of this system be drawn to maximize desired outcomes? How should its boundaries be respected, so that the system's functional

closure can be maintained and the system protected from intrusion damaging to its functioning?

Organisations commonly do not differentiate between risk, and the uncertainty (indeterminacy) that is inherent to functionality (Perminova et al., 2008). To manage internal co-present groups, such as a class or a tutorial group, or an individual or co-present group of workers addressing a delegated problem, the 'parent' system, such as the educational organisation or the employer or professional body, needs to make a differentiation between risk which can or could be known about, and the uncertainty which it has to bear for the potential benefits of using co-present groups. So there are additional questions to be considered in relation to the parent organisation: What is the cost of supporting this co-present sub-system to pursue purposes that are required of it and what level of uncertainty can be tolerated by the supporting system in using this sub-system for this particular purpose? At their most functional, larger-scale systems recognise their role in the provision of resources and the protection of the functional independence of their co-present systems precisely because these can offer the parent system outcomes that cannot be got any other way. However there is always a balance in relation to what control is ceded, what uncertainty about outcomes is tolerated and what anxiety-provoking 'space' is left for the emergence of something new.

In the following chapter I will draw the significant conclusions the thesis.

CHAPTER 8 - CONCLUSIONS

8.1 THE THESIS QUESTIONS

Experiential Questions

While this is a conceptual thesis, its origins are experiential and lie in questions related to aspects of my work practice. The questions, formulated in Chapter 1 'Thesis Outline', are to do with the ever-present gaps in explicit professional knowledge of any practitioner; why practitioners do not believe that these gaps necessarily indicate poor practice and what it means for a practitioner to say that they have 'learned from practice' or 'learned from experience'.

These questions arise for me in an on-going way from my contact with the organisational and institutional structures of my profession, in relation to learning as it is reflected in continuing professional development programs, and more broadly by the profession's assumptions that Evidence-based Medicine, in some format, embodies a representation of how medical practice is or should be carried out, thus defining the nature of knowledge in relation to that practice: how it can be conceptualised, what form it takes and how it is to be learned.

The initial research questions of this thesis can be formulated more abstractly as questions about how to conceptualise learning: how learning is related to practice, in particular, the know-how of learning *from* the experience of practice; about how the production of a body of knowledge comes about, what it means to 'use' this knowledge and how bodies of knowledge, like all other social and socio-cultural phenomena, come to change over time.

Epistemological Questions

Consideration of how learning in relation to practice can be conceptualised raises a further issue, which has become central to this thesis, which is that of what epistemological framework is to be used in thinking about this form of learning. What can be said about the framework we currently use and is it functionally adequate?

As described in Chapter 1, 'Thesis Outline', the traditional model of learning is one which relies on a simple mechanistic handling of entities, substances or 'things'. It has a focus on the cognitive processes of individual learners, and the mind is understood as a container of entities such as thoughts, ideas, pieces of knowledge etc. Learning is understood as a process of acquiring these entities. It is disengaged from actual practice such that practice then becomes a later process of 'application' of knowledge conceptualised this way in new contexts, by 'knowledge transfer'.

In the field of education it has long been recognised that this account of learning is inadequate. While there is evidence that some aspects of learning are particular to individuals, there is also an awareness that social phenomena, both in the form of the immediate context and of the broader social environment, play a role in shaping the processes of learning. This has led to the development of situational and other social theories of learning. It is generally understood that the two foci, of individual and social, reflect different aspects of a complex learning process and that each contributes to an understanding of learning.

However, there are a number of difficulties in conceptualising learning that remain unclarified. These are to do with how these two aspects of learning related to each other and how they are related to practice and to the production and use of knowledge. It is the persistence of these problematic areas in the theorising of learning that have led to the further question that is central to this thesis, which is that of what form of epistemological framework might be needed for re-thinking these issues.

8.2 COMPLEXITY AS AN ONTO-EPISTEMOLOGICAL FRAMEWORK

Examination of the assumptions that underlie the traditional model of practice and learning, which can be seen to underpin the thinking in Evidence-based Medicine, as discussed in Chapter 2, 'Evidence-based Medicine', reveal that they reflect a severely reductive model. While all models are reductive in relation to the phenomena that they attempt to represent, the degree of reductiveness illustrated in Evidence-based Medicine is such that it is unable to function as intended by its originators. Examination of Evidence-based Medicine's functioning suggests that the reductiveness of the traditional

model of practice and learning involves relations; that it is a relational reductiveness. So the first conclusions of this thesis are that it is problematic that the relations used in modelling practice and learning, which are used in the social sciences generally, are commonly limited to the reduced relations of Newtonian mechanics, which can be exemplified by John Dewey's inter-actions. And further, that use of the traditional substantialist framework based on such relations is inadequate for considering issues central to understanding learning, which are those related to the complexity and generativity of the developmental, evolutionary and creative processes of *living* human organisms.

This issue is most relevant for the area of inquiry at what could be described as the intersection of individual functioning with social functioning, such as the point of *service delivery* (to individuals) in education, or the *clinical* aspect of medicine. That is, in those areas of the social sciences where the functioning of the individual as a specific person, or the specific co-present group has significance as part of the focus of inquiry. Here, the basic, bio-psycho-social relations of intra-psychic and inter-personal co-present group functioning, as outlined in Chapter 6, 'Complexity and the Psychological', are complex relations, which can be exemplified as Dewey's trans-actional relations. In trans-actional relations, engagement in the relation defines/creates the participants to it in functional terms, and the process of participation changes the parties to the relation. The relation between participants is a time-critical and evolving relation and its outcome cannot be known at the outset, as it emerges during the process of engagement. It is these relations that characterise living processes rather than reduced inter-actions.

Complexity, as outlined in Chapter 4, 'Complexity' and elaborated on in the two following chapters, when defined as being based on complex, trans-actional relations, provides inquiry with a (relatively) non-reductive onto-epistemological framework. Such a framework encompasses, or has nested within it, the more substantialist frames of inquiry that are based on greater relational reduction. These include the reductive, Deweyan inter-action based form of complexity that originated in the natural sciences, and which is also the conceptualisation of complexity as it is currently reflected in the

literature of the human and social sciences. So, a further conclusion of this thesis is that modelling live social processes, involving the individual as a specific individual, requires a less reduced conceptualisation of relations, and hence the less reduced formulation of complexity to function as an onto-epistemological framework. Such a framework has advantages for human inquiry over the traditional substantialist framework. One of its advantages is that it allows for that aspect of human generativity, psycho-social generativity, to be thought about. It also brings new requirements: the need to recognize limits that are hidden where a substantialist perspective is taken as a starting point, the limits imposed by the indeterminacy of living processes.

Generativity and Indeterminacy

Generativity, reflected in developmental and evolutionary changes in living organisms, is a capacity that is limited to the living: it is the emergence of the *functionally* new. In terms of the psychological and social aspects of human functioning which have been the focus of this thesis, and following Luhmann's sociology (Chapter 5 'Complexity and the Social') and Object-relations psychoanalytic thinking (Chapter 6, 'Complexity and the Psychological'), I understand psycho-social generativity to be the creation of human meaning in its various aspects, and the creation of human meaning, in the service of human survival, to be the central aspect of human psycho-social functioning.

Indeterminacy is always present in any human endeavour. In a substantialist framework indeterminacy is generally conceptualised as a lack, say, of knowledge, or as error, such as a failure of control. It is seen as something outside a 'positivist' form of functioning. However, with complexity thinking, to know something about generativity brings with it the requirement of knowing that not everything can be known about it, and further, that the significance or meaning of what cannot be known is an 'unknown unknown'. This is because, as discussed in Chapter 2, 'Relations and Systems' and Chapter 4, 'Complexity', both the complex relations that give rise to emergent features, and the emergent features themselves, can never be fully determinate. Thus, indeterminacy has a formal place within complexity thinking. Functionally it can be understood as the 'space' in systems that allows emergence to occur.

As it reflects a change in onto-epistemological framework, so complexity thinking brings a requirement for methodological change. For psycho-social inquiry one way of doing this is by a move from thinking in terms of entities, such as for example 'the individual' and 'the organisation', to thinking in terms of functionality and this involves thinking about systems: their relations, their meaning and their limitations, and their processes contextualised by time.

Complexity for Psycho-social Inquiry: Relations, Attractors and Distinctions

To use complexity in a non-reductive way in psycho-social inquiry means to consider mutually dependent systems, and particularly the relations and the attractor/s that characterise such systems. Relations that characterise psycho-social systems are affectively-based trans-actional relations, inherently generative and of maximum human complexity. They serve the autopoietic functioning that is both internal to the individual and shared in co-present groups. Relations of psycho-social systems are found reduced to inter-actional relations in a range of circumstances. They characterise the instrumental use of socially produced entities (ranging from bodies of knowledge to material tools) by individuals. They can also be seen in the instrumental use of individuals by other individuals, for example in the 'isms' of racism or sexism where a complex individual is reduced to a generic example of a social group. They characterise the 'bone structure' of organisations and institutions, which is why individuals can only influence such social phenomena through participation, which is always on the social entity's own, less complex, terms. And they characterise relations between organisations and institutions themselves.

Consideration of relations between systems also variously involves the issues of whether the systems function as environments for each other, whether there is the possibility of sharing some aspects of autopoietic functioning or whether they have an emergent relation with each other. This last issue relates to generativity and can be put another way, as whether or not an individual system has an internal distinction of a micro level of functioning from which an irreducible, macro level of functioning may emerge. For example, individual learning can be understood as an emergent feature,

arising from the bio-psychological processes of the individual body/mind in engagement with others in co-present groups.

Use of complexity also involves thinking about system limits. For psycho-social systems, the individual or the co-present group, limits can be formulated as what in reductive complexity terms is known as the system's attractor/s. In psycho-social systems these are the systems' purpose or meaning/s, *as understood by the system*, an understanding which may differ from the espoused meaning or the externally attributed meaning. This is significant in considering psycho-social functioning because here two complex systems, individual/co-present groups and the larger encompassing social systems, within which they commonly function, are involved. The two systems may share some aspects of attractor/s but these attractors can never be identical. This is because the affective processing of meaning occurs only within co-present groups, including the co-present groups *of* an organisation, and such processing is specific to a particular group in a particular way, at a particular time. For example, a school class shares the wider school purpose of student learning, but the individual class' interpretation of this attractor will always differ somewhat from that of the school as a whole. The processing of affective needs always forms a part, usually unformulated, of a co-present group's attractor. The formation and continued existence of the group depends on this function and its failure is a common source of group dysfunction or disintegration. It is this function that gives such groups their quality of having an evolving uniqueness. This uniqueness of co-present groups, despite the sharing of some attractor function with a 'parent 'system, is the source of variation that produces evolution in the 'parent' social system, in this example, the evolution of a school's culture.

A long-standing problem in psycho-social inquiry is that of dualisms such as micro/macro, structure/agency, body/mind etc. In the field of learning theories this problem is expressed as the individual/social duality in relation to how learning is to be conceptualised. I understand these dualities as a result of use of the substantialist perspective reaching an explanatory limit, a point where relations rather than entities are at issue, where relations constitute the 'entity' to be considered. Use of a complexity

perspective dissolves these dualities; however, this does not produce 'reduction to the whole'. Complexity does maintain differentiations that are internal to the systems as a whole. It does so in the form of distinctions, where differentiation is made on the basis of the differing *relations* that characterise *functionality*, rather than on the basis of substance reflecting entities. A central conclusion of this thesis is that in the context of psycho-social inquiry such distinctions do not create separate entities of 'individual mind' or 'social structure' and that making the distinctions discussed in this thesis, internal to the holistic system of human bio-psycho-social *functioning*, creates mutually dependent but irreducible complex systems, with differing attractors, each representing an *aspect* of human functioning. One is related to the bio-psychological function of processing of shared affect by the individual/co-present group, the other to Luhmann's communicative function of the co-present group in the production, elaboration and use of social phenomena.

8.3 CO-PRESENT GROUP FUNCTION

Taking a complexity perspective as described above, means that human life and processes can be seen as having functional aspects presenting as a series of inter-dependent complex systems: biological, bio-psychological and psycho-social. Each system is in emergent relation to its predecessor and each is differentially constrained by the other systems.

Central to the functioning of these systems is the co-present group. Its primary function is related to human survival through the management of human affective states by socially-influenced bio-psychological autopoietic processes (structural coupling), as outlined in Chapter 6, 'Complexity and the Psychological'. These processes take the form of a system of bio-psychological relations that are both internal to the individual, where they are experienced subjectively as the mind or consciousness, and are affectively shared with other individuals in co-present groups from the mother-infant couple on, throughout life. Individuals function as affectively driven complex systems, each uniquely shaped, biologically and historically, as a 'variation' on the theme of humanity. At the same time, the bio-psychological individual has both emerged from,

and depends for continued existence on, participation in the co-present groups of life, where the affective experiences of life are processed and inter-personal interactions constrain and facilitate, shape but do not control, individual development and the social aspects of human functioning, including the production of social phenomena.

The co-present group is where the affective experience of individuals is shared and processed, and thus is the site of the production or creation of human meaning. This functioning of the co-present group has both 'individual' and 'social' aspects. Co-present group processes lead to changes in bio-psychological functioning of participating individuals which can be understood as the individual learning from participation in the group. Co-present group functioning, in the form of Luhmann's communicative processes, also lead to the production of affectively reduced less complex, communications. These may be formulated and elaborated on, to ultimately produce or change the whole range of social phenomena, from concept to institution.

Such social phenomena are functions rather than entities: their meaning is not determinately inherent. They may be abstract and fleeting, such as concepts are, they may be pervasive and slow to change as the social institutions are, they may be materially embodied as artefacts or tools, but they have a common feature. They are, as functional wholes, less complex than are co-present groups, including those co-present groups that they may produce and use in their functioning. They are constrained by their historical development which is ultimately derived from their attractor/s of meaning or purpose. Their existence and animation depends on their continued use by individuals/co-present groups, where the meaning they bear is produced and reproduced, elaborated on, adapted in new contexts, evolving over time or alternatively, if not taken up, is discarded, ignored and so disappears. However, whatever form social phenomena take, they function in the service of some aspect of common human need.

The significance of complexity for theorising human functioning is that it allows for the attribution of ontological function to (socially influenced) bio-psychological functioning as distinct from 'biological' or 'social' functioning, and without reduction to either the individual or the social whole. This means that aspects of human functioning, for

example human agency, are not wholly a function of the individual but have a social aspect. Conversely, it also means that social phenomena such as, for example, social norms, are not 'things' that are 'applied' to individuals by a process of socialisation, but can be understood as emergent from their production and use in the processes of individual/co-present group functioning and, in turn, available to be appealed to, and used, in various relevant social practices.

Co-present Groups

As I have indicated in the previous chapter, practice and learning can be conceptualised as different aspects of the one process. In a very broad sense, practice in any form that an individual may engage in, will bring about changes in bio-psychological functioning, which can be defined as learning, for that individual. In turn, the engagement will also bring about changes in the co-present groups in which the individual participates, ultimately contributing to the shaping of the social phenomena produced by such groups. This is because, in a circular fashion, any practice involves the individual in a functional engagement with co-present groups. This twofold process is based ultimately in co-present group functioning.

The functioning of co-present groups is constrained by the variations in participating individuals, by the social and cultural contexts within which the co-present group functions and by the group's own history; however this functioning unfolds under the influence of the group's attractor/s. Accepting Luhmann's conceptualisation of human systems as processing meaning, the attractor/s of a co-present group are what the group means to itself, its self-determined functions or purposes. Because a co-present group is a complex system of complex systems whose complexity is partly shared, it has different aspects to its attractor/s. I have described its functioning as twofold. One aspect relates to the function of processing of affect, the other to the emergence of social phenomena. As described above, the processing of affect is present in all co-present group functioning, including that of groups with other aspects of their attractor/s that are related to social practices, such as performing social tasks or of carrying out work processes. Conversely in co-present groups, such as families or friendships, where the

processing of affective states *is* the attractor, communicative processes within the group nevertheless mean that social phenomena, particularly cultural phenomena, will still emerge, in a sense as side-effects of group functioning. The management within such co-present groups of issues such as, for example, sexual behaviours or child rearing activities, give rise to social norms which both emerge from the processes of these groups and may feed back into them, in the form of social constraints.

Practice and Learning

The term 'practice' is commonly understood as a formalised social phenomenon, such as an educational practice or a work practice. In conceptualising human social functioning as I am here, as being based in co-present group function, practice can be defined very broadly as an individual engaging with or undergoing experience of, the world; experience which is then processed, by the individual as party to various co-present groups, to produce the meaning of the experience. Thus common human activities such as making breakfast, or doing the housekeeping, or travelling from A to B, and doing these things in the ways in which they are done in the communities to which the individual belongs, can be understood as practices. Work practices or educational practices then are the same form of process but with greater constraints, related to attractor/s of the co-present groups from which they emerge. So for example, if you are teaching a class or seeing a patient in a medical consultation you are constrained in *what* purposes you pursue, even where *how* you pursue such purposes within the co-present group functioning may be highly complex.

Again, in conceptualising human social functioning as being based in co-present group function, learning by the individual can be understood as an emergent feature of the bio-psychological processing of experience, a process which is partially shared with others, and partially an individual function. It occurs within a social environment that, in a complementary way, is partially shared and partially external to the individual. Further, this environment has historically both contributed to the shaping of the individual's functioning by the mechanism of structural coupling and has been shaped by the individual's participation in the co-present groups of the environment.

Learning is emergent from co-present group functioning, but through the complex system of the individual body/mind and as there are variations between participating individuals' experience and interpretations of the meanings of group processes, learning is constrained, not determinate. Luhmann's 'communications' are emergent from co-present group functioning, but only through the interactions between participating individuals, in a process of complexity-reducing moves which produces material for elaboration into the whole range of social phenomena. Some of these, such as bodies of knowledge, with their indeterminate origins hidden by the reductive moves of their production, are then available as social tools, always contested and always evolving, for use in managing our shared lives.

So, how have my colleagues and I been working and learning from the experience of that work? For each of us, our practice is an engagement in multiple co-present groups. For some groups, such as the clinical encounter and organisational work groups, the group purpose is to discover and manage some problem: a patient's problem or an organisational problem. If we have difficulty with this work, we may use Peer Review Groups, similarly functioning supervision groups or informal 'corridor consults' with known and trusted colleagues where, however fleeting the group, its purpose is to consider the range of ways of managing our specific difficulty, those ways that are possible for us individually and acceptable to the profession collectively. Because these are co-present groups the affective experience of the work is processed. Collective and individual anxiety about the work is managed. Meanings are attributed to the problematic aspects the work, so that they 'make sense' and we are freed to act. Professional knowledge is recalled and thought about, matched with the problems presented, adjusted to make 'better sense' of the specific problem at hand. When we leave these groups we take aspects of their functioning with us, back to our work groups in the, largely unconscious, form of answers to questions of 'how would the group think about this?', and to new work groups where we make what we have learned from our earlier group participation available to the new group. We formally research areas of interest or need, and write papers that become part of the community's professional

knowledge and which future co-present work groups may read and use to put against the new problems that they are considering.

I would argue that this is a familiar mode of human work function. Whether the work is that of a professional group as described, other formal work groups, a community group or a family, co-present group functioning is central to the process and in the process, individuals learn and social knowledge is created.

8.4 CONCLUSION

The conclusions of this thesis are that complexity can be formulated in terms of relational functioning, and that a non-reductive understanding of those relations allows complexity to be used as an onto-epistemological framework in the social sciences for reviewing current theories that have reached a limit of usefulness and for the exploration of new areas of inquiry.

It allows for situations already understood experientially and expressed in human functioning to be reconceptualised, such as, in this thesis, the centrality for human functioning, in *all* social contexts, of the co-present group, the site of creation of human meaning. Co-present group functioning has two emergent outcomes, the understanding or learning for the participating individuals *and* the production of knowledge and ultimately of all other social phenomena.

Complexity opens up subject areas that are under-theorised because of the limitations of the reductive framework traditionally used. The example in this thesis is that of human psycho-social generativity and the accompanying 'not knowing' or limitations of human knowledge. It offers solutions to some long-standing conceptual difficulties, such as how phenomena currently understood as dualisms (body/mind or practice/learning), can be re-formulated, while raising new areas of conceptual difficulty, for example, whether indeterminacy can be encompassed within theory and if so how.

There is something affectively terrible about complexity in the way that it reveals, or rather does not hide, the contingency of our lives and the fragility of the social structures on which we depend. But whatever difficulties may accompany knowing

about this, it also brings the potential for new ways of conceptualising and therefore of managing this fragile life that we do have.

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