The University of Melbourne

Rethinking Organisational Learning

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Declaration of Originality

This thesis contains no material that has been accepted for any other degree in any university. To the best of my knowledge and belief, this thesis contains no material previously published or written by any other person, except where due reference is given in the text.

Signed: [Signature]
Bruce D. Watson
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Abstract

Organisational learning has proven to be a somewhat elusive concept to grasp and therefore its practical implementation has also been difficult. There are various positions on what “learning” is understood to be and there is a lack of synthesis of theoretical and empirical investigations. This thesis argues that the conception of “learning” in the organisational learning literature has received insufficient attention and that this has largely contributed to the lack of clarity in the concept of organisational learning. It is proposed that cognitive science, especially connectionism, provides a model of individual learning that is capable of incorporating implicit and explicit elements of learning and knowledge. Connectionist models of learning mimic the physiological neural processes of the brain and connectionism demonstrates the capacity to combine cognitivist and constructivist theories of learning. To accomplish the transition to an explanation of collective cognitive processes as occur in organisations, and while continuing to recognise the individual neural processes that must be involved, it is proposed that the theory of situated action is united with connectionism. On the basis of such, this thesis proposes a reconceptualisation of organisational learning and a new framework to guide management practice.
Chapter 1:

Towards Reconceptualising Organisational Learning

1.1 Introduction

In the last two decades there has been considerable emphasis placed on “learning” and the concept of “organisational learning” as a means by which managers can “bring out the best” in their organisations. While new organisational structures and processes may be necessary to remain competitive, organisational learning is regarded as something of significance to be adopted as part of organisational change. However, organisational learning has proven to be a somewhat elusive concept to grasp and, not surprisingly, its practical implementation has also been difficult.

This Chapter sets out to clarify the problems and weaknesses associated with the field of organisational learning. Initially there is a review of how organisational learning consists in the research literature both in theoretical and empirical terms. Upon analysis of the foregoing, the application of a consistent theory of learning is found to be a major contributing factor that impedes the development of the field of organisational learning. The need for a new framework to understand organisational learning is discussed together with how a new framework may influence management practice. A theoretical platform and appropriate research methodology is described by which a new
framework of organisational learning may be constructed. Hence, it is proposed that there are useful theoretical perspectives and empirical evidence that enable a new view of organisational learning. It is further proposed that the reconceptualisation of organisational learning may influence management practice.

1.2 The Theory

Some seventeen years ago, Fiol and Lyles (1985) reported that a systematic assessment of the strategic management literature showed that “...no theory or model of organisational learning is widely accepted” (Fiol and Lyles 1985, p. 803). The authors made a distinction between organisational learning and organisational adaptation and argue that change does not necessarily imply learning. They further suggested that despite the divergence of views there were some areas of consensus or agreement, such as environmental alignment, the distinction between individual and organisational learning, and contextual factors. More importantly, they concluded that there is not a clear understanding of what learning is. They highlighted the confusion surrounding “learning” and “adaptation”, and “behavioural development” with “cognitive development”. Fiol and Lyles (1995) argued that organisational learning and change were two different processes and concluded that:
Organisational learning that represents changing associations, frames of reference, and programs begs a methodology that demands a more in-depth look at the functioning of the organisation. In order to measure lower level learning, one can look at changes in the systems and so on, but to distinguish it from purely behavioural adaptation one needs to know if association development has occurred.

(Fiol and Lyles, 1985, p. 811).

Levitt and March (1988) partitioned their analysis into sections that considered learning from direct experience, interpretation of experience, organisational memory, learning from the experience of others, ecologies of learning and learning as a form of intelligence. In a similar vein, Dodgson (1993) noted that studies in organisation theory, industrial economics, economic history, business, management and innovation studies all approach the question of how organisations learn (Dodgson, 1993, p. 375). He conducted his analysis in the broad areas of the goals of organisational learning, the learning processes in organisations, and the ways in which organisational learning may be facilitated or impeded. Hence Dodgson concluded:

...the strength of analyses within an organisation theory perspective, when supplemented by some concepts from
psychology, lie in the comprehension of the process and problems of learning. The strengths of the economics/management and business/innovations approaches lie in motives and sources of learning... Much of its [the organisational learning literature] analysis of learning is, however, limited to its outcomes, and it ignores or underestimates the problems and complexities in the processes of learning.

(Dodgson, 1993, p. 390).

Huber (1991) undertook a critical analysis of the organisational learning literature analysing the literature from the constructs of knowledge acquisition, information distribution, information interpretation and organisational memory. He concluded that there was lack of synthesis of the work on organisational learning (Huber, 1991, pp. 124 – 162).

As is evident from the above, the field of organisational learning is multifaceted and a wide diversity of opinions exists. The sample of literature serves to demonstrate that despite the plethora of organisational learning concepts and theories that have been present in the management literature for at least twenty years, there appears to be a dearth of concrete information which can be confidently considered and used by managers for organisational learning. In large measure this appears to be due to the varied positions on
what “learning” is understood to be. The literature tends to change according to the learning theory construct adopted by a particular author. Similarly, definitions of organisational learning abound but they are not particularly helpful because, by all accounts, the conception of learning referred to in organisational learning is largely assumed and unexplained. It appears that a new approach is required to address the concept of organisational learning if it is to advance and be a useful management tool.

1.3 The Practice

Evidence is mounting that recent organisational change and management approaches couched in terms such as restructuring, re-engineering, delayering, downsizing or rightsizing have not produced the desired outcomes of increased productivity and profitability (see for example Dawkins et al, 1999: 2001). The following two examples serve to demonstrate some of the limitations of recent management and organisational change writing.

“The Learning Organisation” is a generalised approach to organisations and organisation change. In 1990, Senge published his book *The Fifth Discipline: The Art and Practice of the Learning Organisation*. In summary it was asserted that “The Learning Organisation” is better at adapting to rapidly changing external circumstances and better equipped to become more productive and efficient in accomplishing its goals. Senge (1995) regards
other organisations as simply adapting. A large amount of material is published under the theme of “The Learning Organisation”, however, Senge is arguably the most cited. There is virtually a whole industry based around “The Learning Organisation” as it has become an end in itself.

From 1990 to the mid-1990’s “The Learning Organisation” achieved “hallowed status as the corporate ideal” (Boas, 1997, p.71). Argyris and Schön (1996) describe Senge’s approach as “utopian in flavour” and “prescriptive” (Argyris and Schön, 1996, p. 184). Notably, some years after the publication of his book, Senge himself suggests that there is no such thing as a “learning organisation”, but that there is a vision for creating an organisation we would like to work in (Senge, 1997, p. 17). Senge’s concept of “The Learning Organisation” rests within systems thinking (Senge and Fulmer, 1993). There is no allowance for the unpredictability of individual or group human action, different organisational structures, the context of work or specific local content. All of the preceding elements of organisation are contributing factors to organisational learning, however, they are obscured by filtration through a general systems model. Consequently, the system dynamics approach to organisational learning is largely descriptive and, while suggestive of participatory organisational structures it cannot offer one that could be applicable to all organisations. In this regard, Ivanoff and Jakiah (1997) noted “an increasing level of concern, tending towards cynicism” regarding “The Learning Organisation” as “it seems easier to make statements
about what a learning organisation would be like than it is to identify the concrete action necessary to turn a desirable objective into reality” (Ivanoff and Jakiah, 1997, p. 28). Hence, Finger and Brand (1999) argue that “The Learning Organisation” is an ideal whereas “organisational learning is the activity and the process by which organisations eventually reach this ideal of a learning organisation” (Finger and Brand, 1999, p. 136).

Another example of the possible outcomes of constricted approaches to organisational change is to be found in the concept of “reengineering”. Champy (1995) states that after an initial period of acceptance and application reengineering is in trouble (Champy, 1995, p. 1).

The results are in: Reengineering works – up to a point. The obstacle is management. The only way we’re going to deliver on the full promise of reengineering is to start reengineering management – by reengineering ourselves.

(Champy, 1995, p. 3).

Champy was one of two writers who introduced the concept of “reengineering” organisations in the early 1990’s (Champy and Hammer, 1993). Reengineering has an emphasis on changing the operational processes performed by employees, however, it has a tendency to overlook the “human element”. Champy has since altered his position to include the need for
managers to change their managerial work, so that “the way we think about, organise, inspire, deploy, enable, measure, and reward the value-adding operational work. It is about changing management itself.” (Champy, 1995, p. 3). The significance of Champy’s (1995) change in position is his recognition of the human element of organisations and the role managers can take in improving organisational operations by the way they view and interact with the operational personnel. Perhaps not unexpectedly, “learning” features in “new reengineering” just as it does in Senge’s “Learning Organisation”. Champy’s (1995) emphasis is on learning by individuals. He concludes:

It all comes down to learning. If we could get an organisation of 26 000 learners who are coming in every day and learning new ways to grow and improve, we could be the most competitive company in the world.

(Champy, 1995, p. 131).

These two examples serve to demonstrate that the mainstream management literature, similar to the academic organisational learning literature, has tended to be largely descriptive and has developed from restricted knowledge bases. There is a further tendency to overlook the need to expand the concept of organisational learning to include a causal account of the cognitive powers of human beings (Evers and Lakomski, 2000, pp. 73 - 74 ).
1.4 Some General Problems in the Field

Littler et al (1994) argue that the type of management consultancy writing described above has overlapped too strongly with the organisational change literature. In their view it is the amalgam of under-researched idealistic management and organisational concepts, together with a general lack of integrated research, that creates a range of inappropriate idealistic solutions to complex management problems. They further suggest that under-researched, mainstream management consultancy writing in organisational change needs to be replaced by empirically-based knowledge of organisational processes. Until such time, the advancement of the field of organisational change is unlikely to make significant progress (Littler et al., 1994, p. 27). In a somewhat similar vein, and despite the plethora of organisational changes over the last ten years, Greiner (1998) remarks:

Researchers are just beginning to study the specific developmental problems of structure, control, rewards, and management style in different industries and in a variety of cultures.

(Greiner 1998, p. 67).

Recently, Argyris (2000), who has studied organisations and management for more than two decades, has provided analyses and approaches on how to be
more critical of the business and corporate advice that has been available so freely. He has gone so far as to argue:

In my judgement, most of the advice is – most of the time – simply not actionable. And even if it is implemented correctly, it will lead to consequences that run counter to the intentions of those providing it.

(Argyris, 2000, p. 3).

Nicolini and Meznar (1995) argue in particular that an understanding of knowledge and cognitive processes has not featured strongly in contemporary management practice and that because of this:

It might be the case that what has sometimes been referred to as the "art" of management simply reveals the shortcomings of a particular way of interpreting the relationship between knowledge, formal and abstract systems of knowledge, and situated human action.

(Nicolini and Meznar, 1995, p. 744)

It seems reasonable to assume that managers, who understand how they learn themselves and also how groups and individuals learn, based on the best available models of learning, will be in a strong position effectively to manage
organisational learning and organisational functioning. Notably, Johnson (2000) records the value now placed on tacit learning, and learning how to learn from a range of sources, in the business world. In fact, she argues that learning opportunities arise in virtually every interaction between individuals, teams and organisations and that these opportunities can be created and capitalised on (Johnson, 2000, p. 4).

Given the implicit nature of organisational learning described earlier, it is not surprising that Schein (1997) suggests that organisations have not learned how to manage organisational learning (Schein, 1997, p.1). He discusses the misalignment that occurs between the “executive culture”, the “engineering culture” and the “operator culture” and how it is this that causes failure in organisational learning (Schein, 1997, 13 - 17). This, again, is not surprising because the various operational levels in the organisation (and quite likely, each individual) probably have different constructs of what organisational learning is, given the variability found in the literature. In relation to this, Sharratt and Field (1993) argue the need for organisations to move towards innovations that inter-twine work and learning and involve all levels of an organisation. One of the most important changes, they suggest, is to gain a greater understanding of the concept of learning and the role it plays in organisations (Sharratt and Field, 1993, p. 139). This further reinforces the interdependence of individuals and an organisation in relation to learning.
An appreciation and application of cognitive processes in management studies is occurring. Some recent books demonstrate this development. Eden and Spender (1998), for example, observe that there has been alignment taking place between management practice and cognition processes, particularly in the last decade (Eden and Spender, 1998, pp. 1 - 4). Chapters in their book are devoted to the dynamics of individual and organisational knowledge, theory and praxis of reflective learning in strategy making, the political and social dynamics of cognition, mental models of competition and so on. In a similar vein, Eagstrom and Middleton (1999) provide a useful introduction to the literature concerned with linking knowledge with organisation. There is an emphasis on social interactions, communication and the notion that organisation cognition must be based on an understanding of the social context in which cognition is embedded. Boud and Garrick (1999) provide critical analyses of the current debates surrounding workplace learning and particularly note the shift away from traditional educational institutions as the prime resource for learning applicable to workplaces (Boud and Garrick, 1999, pp. 2 - 3). Together with the inclusion of cognitive considerations in the management literature are the findings of recent empirical research that have lead to the concept of the “learning manager”. more specifically, the identification of negative or positive attitudes of managers towards learning (see Antonacopoulou 1999).
1.5 Main Thesis Argument

This thesis argues that the “learning” referred to in the organisational learning literature has received insufficient attention and that this has largely contributed to the lack of clarity in the concept of organisational learning. The implementation of effective organisational change using organisational learning as a significant resource, so it is proposed, will depend on managers who have a contemporary understanding of learning and who also possess more than a simple appreciation of cognitive processes. This is suggestive of the need to appreciate the difference between “knowing that” (ability to represent and store information) and “knowing how” (ability to perform an action). “Knowing that” therefore does not necessarily equate with the ability at performance or competence at a task (see Eiser, 1994, pp. 123 - 124).

Boud and Walker (1991) emphasise the importance of learning by experience when they state:

No matter how much formal education and training people receive, they will not really be equipped for a position of responsibility unless they have the ability to learn from their experience. Some formal education and training can help this learning process but, in the main, the issue of how people learn after they have completed their formal training has not been well
researched. On-the-job training is left to the commonsense of either the individual, the supervisor or the manager who are expected to deal with situations as they arise.

(Boud and Walker, 1991, p. 9).

The greatest challenge would appear to be finding ways of conceptualising learning from experience and putting it to effective use.

Given that more attention is required to the “learning” in organisational learning, there is also the need to align this expanded view with “organisation”. In order to draw together “learning” and “organisation” as a conceptual and theoretical framework, this thesis relies on the works of Argyris and Schön (1996). While they appear to side-step a detailed account of learning and cognition (see Argyris and Schön, 1996, pp. 4 - 6), the reason for selecting these particular researchers is that they have contributed to the field of organisational learning for over two decades. They discount the sceptical scholarly literature which is “intentionally distant from practice, non-prescriptive, and value neutral” (Argyris and Schön, 1996, p. 188).

According to Argyris and Schön (1996), organisations “hold knowledge” and “represent knowledge” concurrently (Argyris and Schön, 1996, pp. 12 - 15). The authors distinguish between “espoused theory” (the justification for action) and “theory-in-use” (the way that action actually occurs) that apply to
individuals and organisations. These “official” and “actual” views of action are important as they draw attention to the explicit and implicit levels of both knowledge and learning which are active on a daily basis within organisations. Hence, “espoused theory” and “theory-in-use” are subsets of an organisation’s overall “theory of action”. The theory of action represents the way in which an organisation ultimately conducts its business through a form of “action research” in which organisational members are “co-researchers” (Argyris and Schön, 1996, p. 50). However, organisational learning does not simply equate with the sum of the “learning parts” (the individual brains of employers and employees). Argyris and Schön (1996) give attention to both individual and organisational learning in organisational settings. They regard organisations as collectivities. At the crux is the difficulty of linking the individual to organisational processes (Argyris and Schön, 1996, pp. 4 - 6). Individuals learn but “when the knowledge held by individuals fails to enter into the stream of distiactively organisational thought and action, organisations know less than their members do” (Argyris and Schön, 1996, p. 6, italics in original source).

Argyris and Schön (1996) consider the issue of organisational learning via “organisational action” and conclude that it is by the establishment of rule-governed ways of deciding, delegating, and setting the boundaries of membership that a collectivity becomes an organisation capable of acting (Argyris and Schön, 1996, pp. 6 - 8). They describe organisations as
cooperative systems governed by the constitutional principles of a polis (Argyris and Schön, 1996, p. 9).

If a collectivity meets these conditions, so that its members can act for it, then it may be said to learn when its members learn for it, carrying out on its behalf a process of inquiry that results in a learning product. (Argyris and Schön, 1996, p. 11. italics in original source).

Argyris and Schön (1996) provide a useful framework for exploring organisational learning because they attempt to integrate both the theoretical and practical strands of organisational learning. However, it is necessary to keep their contribution in perspective. Robinson (2001), in her analysis of Argyris and Schön’s research, suggests that they have particularly contributed to the normative research strand. Robinson therefore argues that Argyris and Schön are primarily concerned with finding ways of directing organisational learning that help in the reaching of organisational goals. Such a contribution is in contrast to the descriptive research strand which seeks to understand the processes in organisational learning (Robinson, 2001, p. 58). Hence,

Deliberative learning of the sort promoted by Argyris and Schön works on a symbolic representation of organisational action through detailed analysis of verbal accounts of organisational
life. Even if great care is taken to ground those accounts in concrete referents, much of the knowledge embedded in organisational action may not be represented and learned in this way.

(Robinson, 2001, p. 61).

Robinson argues that one of the troubling aspects of Argyris and Schôn's approach to organisational learning is its generic properties that suggest that problem solving capacity in a particular context is transferrable to another context. In her view, research on problem solving tends to suggest that it is not possible to abstract knowledge and skills developed in one context for use in another. Therefore, Robinson concludes:

It may be the case that the intensive organisational interventions that Argyris and Schôn have documented, some of which have continued for up to ten years, have produced generalised change, but the issue at stake is whether they have done so without practice in how to instantiate values of enquiry, openness and testing in every context in which learning is evident.

(Robinson, 2001, p. 66).

It is clear that a new approach is required to address the traditional conception of organisational learning if it is to advance. Such an approach requires:
i. a multidisciplinary approach to understand knowledge and learning.

ii. an understanding of the linkages between knowledge, learning and doing.

iii. an understanding of how individual knowledge and learning relate to collective knowledge and learning.

iv. an understanding of the role that knowledge and learning play in organisations.

v. a greater appreciation of explicit and implicit knowledge and learning.

1.6 Theoretical Frame of Reference and Methodological Orientation

This thesis adopts the research methodology framework for the behavioural sciences proposed by Kaplan (1994, pp. 5043 - 5050), as he softens the boundary between methodology and theory which is appropriate for a conceptual-theoretical research study of this type. According to Kaplan, there is no sharp dividing line between methodology, technics (observation, measurement) and philosophy (Kaplan, 1994, pp. 5043 - 5044). In his view, particular enquiries often involve all three aspects. Kaplan argues that this makes sense because it is the three elements of enquiry together that provide the way in which the world is comprehended at the time of a particular study (the context and conceptual frame).
All inquiries are carried out in specific contexts. Validation of the results of any particular enquiry by reference to the outcomes of other inquiries is important. How important varies with the distance between the respective subject matters, concepts, data, and other components of the process of inquiry.

(Kaplan, p. 5050).

Contemporary cognitive science, it is argued here, provides an appropriate knowledge base to explore and rethink the concept of organisational learning. This is suggested because science is rapidly developing understandings of the mechanisms of cognition and the functioning of the human brain. For example, it is now generally understood that the brain:

i. integrates and stores experiences...it self-organises experience.

ii. considers new experiences in the context of stored experiences...[and] often requires a type of high-level, symbolic, or iconic matching ability, as well as a means to "index" stored past experiences from different viewpoints...

iii. is able to make accurate predictions about new situations on the basis of previously self-organised experiences... [suggestive of] a generalisation capability.
iv. does not require perfect information...[there] is tolerance of deformations of input patterns or perturbations in input data, including incompleteness...

v. represents a fault-tolerant architecture...loss of a few neurons may be recoverable by adaptation of those remaining...

vi. seems to have available, perhaps unused, neurons ready for use...[suggesting] that the system does not stop learning once it is fielded.

vii. does not provide, through microscopic or macroscopic examination of its activity, much useful information concerning its operation at a high level...

viii. tends to cause behaviour that is homeostatic...

(modified extract from Schalkoff. 1997, p. 8).

The knowledge acquired through advances made in the understanding of brain function in the last few decades has the potential to be a major influence on all applications of learning and learning environments. Consequently, contemporary cognitive science is demonstrating the capacity to provide challenging information to traditionally held views on learning as it draws together the knowledge of psychology, anthropology, linguists, computer science, and neuroscience. Some researchers include philosophy in this list in aiming for an understanding “mind” as there is considerable variation of
views. This area of debate is considered in Chapter Four. In general, cognitive science aims to develop understanding of perception, thinking, remembering, understanding language, learning, and other mental processes. These are all processes associated with learning environments such as educational institutions and other organisations. However, Sylwester (1995) argues that educators have tended to focus on:

...the visible, measurable, pliable manifestations of cognition, rather than on cognitive mechanisms and processes. The human brain uses sensory/perceptual processes to take in objects and events in the environment. It then draws on memory and various problem-solving strategies to process the information, and it eventually translates thought and decision into behaviour. (Sylwester, 1995, pp. 2 - 3).

Sylwester's observation supports the view that new models of learning need to be considered if learning itself is to be more fully understood. In this regard, it is noteworthy that Caine and Caine (1991, 1997, 2001) challenged the U.S.A. education system with a new theory of learning that they base on contemporary scientific findings concerned with how the brain functions.

Cognitive science studies the mind and cognitive processes. In broad terms there are currently two contributing fields of research in cognitive science,
referred to as artificial intelligence (established *circa* 1940, Stillings *et al.* 1995, p. 22) and, more recently, connectionism (established *circa* 1980, Stillings *et al.* 1995, p. 63), that are both prominent in the contemporary cognitive science literature. Artificial intelligence is chiefly concerned with thought processes being represented by the manipulation of symbols such as letters, numbers and language, as is seen in computer software programming (see Fig. 1 below).

```vbnet
Function fCreateQuery() As Integer
'Purpose: Complete the SQL statement.
    close frmFieldWizard
    'Open frmQueryWizard
    'Called by: OnPush event of the cmdCreateQuery button
    'Returns: Nil
    'Add the last field to the SELECT field list
    If wNumFields > 1 Then
        'Add trailing comma
        strSQL = strSQL + ","
    End If
    strSQL = strSQL & " " & strLastField
    'Add the last sort field to the ORDER BY field list
    If wNumSorts > 1 Then
        'Add trailing comma
        strSQLsort = strSQLsort + ","
    End If
    strSQLsort = strSQLsort & " " & strLastSort
    'Reset the last field values
    strLastField = ""
    strLastSort = ""
    'Launch the Query Wizard Form
    DoCmd.Close A_FORM, "frmFieldWizard"
    DoCmd.OpenForm "frmQueryWizard"
End Function
```

Figure 1. Portion of a computer program that demonstrates symbolic representations and rules in a required sequence to produce a desired outcome, in this case the ability to access specific management data from a data bank. (Source: Jennings, 1994, p. 354).

Connectionism, by contrast, is based on mimicking the neuronal architecture of the brain in which there are many interconnected nerve cells variously in an activated or non-activated state in any period of time (see Fig. 2 below).
Fig. 2. Schematic side view of brain cortex showing the networking of neurons. (Source: Sylverster. 1995. p. 46).

As will be demonstrated in Chapter Four, it is the neural plausibility that makes connectionist modelling of learning attractive when trying to come to terms with how learning occurs. While connectionist models are artificial learning systems they are the closest available representation of how biological learning systems, such as the human brain, function. For example, artificial neural networks have been shown to be capable of performing many
operations simultaneously, just as the neuron cell networks can in a brain. It is possible to mimic the way in which the brain processes complicated cognitive actions in less than one second. A serial computer program, as found in artificial intelligence, adopts a strictly linear "one-logical-step-at-a-time" approach so that the same complicated cognitive action would take much longer than one second to reach completion (Stillings et al., 1995, p. 71). Whereas artificial intelligence models store information as data structures, connectionist systems store information as patterns of recognition that can be created and re-created as the need arises via the activation or deactivation of artificial neurons or "nodes" (see Figure 3 below). Artificial intelligence and connectionist models of learning are compared and contrasted in more detail in Chapter Four.

![Simple Artificial Neural Net](image.png)

Figure 3. Simple Artificial Neural Net consisting of six interconnected nodes. (Source: Kartalopoulos, 1996, p. 50)

St. Julien (1997, pp. 267 - 269) argues that connectionism has the capability to link learning, experience, context and situation and that it therefore provides a conception of knowledge and learning that can move beyond symbolic and verbal activities. Additionally, Evers and Lakomski (2000) argue that new
ways to explain how organisations can function and learn as cognitive collectivities is possible by means of connectionism (Evers and Lakomski, 2000, p. 74). Given time, Churchland (1998) proposes that skills characterised in behavioural terms, such as planning, preparing and cooperating, will be specifiable through connectionist models of learning (Churchland, 1998, p. 247). Connectionism therefore seems highly significant in any consideration of learning that occurs in an organisational setting. Organisations are, after all, socially constructed environments consisting of individuals who all have the capacity to learn from one another, and “the accepted-preferred way things are done” in a particular organisation.

Lakomski (1999) has argued:

...while cognition is social in the sense of being accomplished within broader cultural frameworks. It is also in some sense the accomplishment of an individual mind/brain in interaction with other minds/brains.


Granted that organisations do not literally have brains, they consist of a collective of brains, which contribute to organisational memory, behaviours, mental maps, norms and values. Organisations also develop a collective or organisational culture. This therefore supports the view that connectionism
may assist in developing an understanding of learning in collectivities. Further support for this argument is found in the work of Hutchins (1995) who rejects the notion that cognition is individually owned. He extends the social and cultural argument by suggesting that the cognitive unit of analysis should extend beyond the individual. According to Hutchins, a new framework is needed to understand what is most characteristically human about human cognition, a framework that does not distinguish between what goes on inside a head and what lies beyond it (Hutchins, 1995, pp. 353 – 374).

As will be demonstrated in this thesis, “situated action” is a conglomeration of theoretical perspectives that take into account how individuals learn through their interactions in socio-cultural contexts and the environment, in much the same way as Hutchins (1995) describes. Further, it is demonstrated that situated action assists in explaining how cognition is distributed rather than the domain of individual brains. Situated action therefore provides a useful platform to make the transition from the most credible explanation of individual learning to that of collective learning in organisations.

It is argued here that a management approach informed by knowledge of how brains work as it applies to individual and collective learning is likely to be considerably more effective than relying on the largely descriptive understandings of organisational learning that are prominent in contemporary management literature, and the generally prescriptive nature of organisational
reform literature. This thesis offers a new conception of organisational learning and its application to management practice. A conclusion is reached as to the most effective learning approach or approaches to be adopted for organisational learning.

1.7 Summary and Chapter Outlines

This Chapter has, in general terms, described the problems and weaknesses associated with the field of organisational learning both in the theoretical and empirical literature. At the crux of the problems and weaknesses is the lack of a consistent, credible theory of learning. However, it is argued that there are useful theoretical perspectives and empirical evidence that may be united to construct a new conception of organisational learning applicable to management practice.

This thesis is structured to consider initially the theoretical and empirical contributions to organisational learning in Chapter 2 and Chapter 3. In these Chapters a survey of representative theoretical and empirical organisational learning literature will provide the means to more fully identify general themes and some of the contentious issues concerning the current conception of organisational learning. The empirical investigations particularly provide an insight into how researchers have tried to address the complexities
involved in collective learning with the aim of informing management first-hand of how to optimise organisational learning.

Chapter 4 compares and contrasts two contemporary cognitive science models of learning, artificial intelligence and connectionism. This includes a brief analysis of the long-standing theoretical debate that separates the two models of learning. A conclusion is reached that connectionism, which mimics brain functioning, offers the best current model of how learning occurs.

Chapter 5 considers individual learning, particularly in regard to the development of professional expertise, including management, and the important role that implicit learning takes in this process. The contentious issues surrounding implicit learning are highlighted. However, connectionism is found to be capable of providing an explanation of implicit learning.

Chapter 6 considers individual and organisational tacit knowledge, as the concepts of learning and knowledge are so closely related. Despite the existence of managerial processes designed to extract tacit knowledge, this Chapter provides evidence for the inherent difficulties in believing that such processes can be successful.

Chapter 7 extends the unit of analysis from the individual to collective learning. Sociocultural aspects of learning are analysed from the theoretical
constructs of "situated action". Recent, though somewhat preliminary, research in collective connectionist experiments are found to be supportive of the notion that cognitive properties of socially distributed systems are influenced by particular situations and environmental factors.

Chapter 8 draws together the information in the preceding Chapters to form a framework for a reconceptualisation of organisational learning based on the current connectionist account of learning. The Chapter concludes with presenting some implications of a new view of organisational learning for managers and management.
Chapter 2:

Theoretical Conceptions of Organisational Learning

2.1 Introduction

The literature on organisational learning is vast. For example, Crossan and Guatto (1996) undertook a bibliographic review that compared publication rates since 1969 which shows a massive increase in the number of publications concerning organisational learning particularly beginning in 1990. In the four year period 1990 to 1994, inclusive, the number of publications almost quadrupled (Crossan and Guatto, 1996, p. 108). Cohen and Sproull (1996) also note the huge amount of literature concerned with organisational learning and the variety of approaches adopted. Most recently, Dierkes et al (2001) have brought together a collection of papers endeavouring to draw together the thinking on organisational learning from different disciplines and sub-disciplines including sociology, management science, economics, anthropology, political science and history. So varied are the conceptions of organisational learning from different disciplines that Easterby-Smith (1997) argues against any attempts to create a single framework.

For the purposes of this thesis, the field of organisational learning may initially be understood by considering some of the important contributions made towards its development. The objective of this Chapter is to identify
some recurring themes and contentious issues in the organisational learning literature, to be listed in the concluding paragraphs. Following a brief description of current individual learning theories to act as a framework throughout this Chapter and the thesis, succinct descriptions of the varied positions adopted by a selection of contributors to organisational learning theoretical frameworks is considered in terms of their:

i. definitions, general frameworks and viewpoints

ii. conceptions of learning

iii. understanding of the learning entity (For example, individuals or collectivities)

iv. position on learning content and learning processes

The selection of authors is made with a particular view towards demonstrating representative and varying concepts of epistemology and learning as they have been applied to organisational learning. Thus, the predominant learning theory influence for each author is also identified. In concluding, this Chapter identifies key contentious issues and recurring points of agreement in the theoretical organisational learning literature

2.2 General Categories of Theories of Individual Learning

In the absence of a generally accepted theory of organisational learning it seems appropriate initially to have an overview of theories of individual
learning. Presumably they will have had some influence in the formulation of concepts of organisational learning, and they provide an initial frame of reference. Broadly, there are three current learning theory categories that apply to individual learning. These are behaviourism, cognitivism and constructivism. These theories will be considered in more detail in later Chapters, however, a basic appreciation of the distinction between the theoretical positions is helpful for the following analysis of theoretical positions adopted in the organisational learning literature. It must be emphasised, however, that the categorisation is one of convenience for a range of extremely complex learning theories that may even overlap in some respects.

Behaviourism concentrates on changes in behaviour that can be observed and measured. Everything is defined in terms of behaviour hence learning is judged to have occurred where there are observable changes in behaviour (Lefrançois, 2000, pp. 27 - 133). There is a focus on new behaviours being repeated until they become automatic.

Cognitivism takes into account the thought processes that are linked to behaviour. Hence, changes in behaviour are used as indicators as to what is happening in a person’s head. Accordingly, the emphasis is on understanding higher mental processes of human beings that influence and determine specific behaviours and processes (Lefrançois, 2000, pp. 155 - 233). The term
“information processing” is closely aligned with cognitivism and indicates its links to computer science.

Constructivism is based on the idea that people construct their own perspective of the world through their individual experiences and share this through processes of social negotiation and experience. Hence, in this case “knowledge is made, not acquired” (Phillips, 2000, p. 7). Skill, expertise and experience are closely associated with constructivism.

2.3 Definitions, General Frameworks and Viewpoints of Organisational Learning

As is common practice, many authors initially provide their own definition of organisational learning, particularly where their position differs significantly from other authors. Definitions can be useful, at least initially, in assisting with clarifying and contrasting what organisational learning as a concept entails. Other authors do not specifically define organisational learning, rather, they provide a general viewpoint or framework of understanding the concept. As will become apparent, however, a difficulty arises where there is considerable variation in the possible meanings for the term “organisational learning”.

Argyris and Schön (1996) have been consistent contributors to understanding organisational learning. In this respect they represent an important reference
point for this thesis, hence it is appropriate to note their full definition of organisational learning:

Organisational learning occurs when individuals within an organisation experience a problematic situation and inquire into it on the organisation’s behalf. They experience a surprising mismatch between expected and actual results of action and respond to that mismatch through a process of thought and further action that leads them to modify their images of organisation or their understandings of organisational phenomena and to restructure their activities so as to bring outcomes and expectations into line, thereby changing organisational theory-in-use. In order to become organisational, the learning that results from organisational inquiry must become embedded in the images of organisation held in its members’ minds and/or in the epistemological artefacts (the maps, memories, and programs) embedded in the organisational environment.


Hedberg (1981) adopts the position that:

Learning takes place when organisations interact with their environments: organisations increase their understanding of
reality by observing the results of their acts. Often the acts are experimental ones. In other instances, organisations learn by imitating other organisations’ behaviour, or by accepting others’ experiences and maps of the environment...

...it is individuals who act and who learn from acting; organisations are the stages where acting takes place. Experiences from acting are stored in individuals’ minds, and these experiences modify organisations’ future behaviours. The acting generally accumulates into trial-and-error sequences that incorporate experiments by both organisations and their environments.

Organisational learning includes both the processes by which organisations adjust themselves defensively to reality and the processes by which knowledge is used offensively to improve the fits between organisations and their environments.

(Hedberg, 1981, p. 3).

Fiol and Lyles (1985) make a distinction between cognitive and behavioural change. In their view:
Organisational learning means the process of improving actions through better knowledge and understanding. (Fiol and Lyles, 1985, p. 803).

Levitt and March (1988) also mention the significance of behaviour and argue that:

Organisations are seen as learning by encoding inferences from history into routines that guide behaviour.

(Levitt and March, 1988, p.319).

While also emphasising behaviour, Huber (1996) posits that:

An entity learns if, through its processing of information, the range of its behaviours is changed.

(Huber, 1996, p.126).

The important distinction in Huber’s definition is the observation “the range of behaviours is changed”. This is because Huber recognises that “learning need not result in observable changes in behaviour” (Huber, 1996, p. 126, italics in original source).

With the clarification that a unit may be an entity such as an individual or group, Huber (1996) argues that:
...an organisation learns if any of its units acquires knowledge that it recognises as potentially useful to the organisation...an organisation learns something even if not every one of its components learns that something.

(Huber, 1996, p. 126).

Huber clarifies that his use of the phrase "that it recognises as potentially useful" is helpful in that it negates the need to consider information acquired but not recognised as potentially useful, termed "lateat information" (Huber, 1996, footnote p. 153).

Unlike the previous authors, Weick and Roberts (1996) do not specifically use the term "organisational learning". They do, however, refer to factors that relate to learning, such as improvisation, interpretation, assimilation, selection, and heedful interrelation. Rather than defining organisational learning, Weick and Roberts conceptualise it as:

...as a pattern of heedful interrelations of actions in a social system...


This they call "collective mind". Where a "collective":
...refers to individuals who act as if they are a group. People who act as if they are a group interrelate their actions with more or less care, and focusing on the way this interrelating is done reveals collective mental processes that differ in their degree of development.


Brown and Duguid (1996) provide a significant conceptual shift by reassessing the interrelatedness of work, learning and innovation. In their view, formal descriptions of work and learning have been abstracted from practice to the point that significant detail is lost. They observe that society tends to value abstract knowledge over practical knowledge which is generally reflected in education and training programs. In this regard Brown and Duguid argue that intricacy of practice is at the crux of understanding work and that:

Without a clear understanding of those intricacies and the role they play, the practice itself cannot be well understood, engendered (through training), or enhanced (through innovation).

(Brown and Duguid, 1996, p. 59).

Cook and Yanow (1996) specifically define organisational learning as:
...the acquiring, sustaining, or changing of intersubjective meanings through the artifactual vehicles of their expression and transmission and the collective actions of the group.

(Cook and Yanow. 1996, p. 449).

According to these authors, organisational learning:

... refers to the capacity of an organisation to learn how to do what it does, where what it learns is possessed not by individual members of the organisation but by the aggregate itself. That is, when a group acquires the know-how associated with its ability to carry out its collective activities, that constitutes organisational learning.

(Cook and Yanow. 1996, p. 438)

Popper and Lipshitz (2000, pp. 182 - 184) allude to the confusion that surrounds definitions and conceptualisations of organisation learning and learning organisations. They argue that there are considerable similarities between individual learning and organisational learning by referring to a modified cyclical model of individual experiential learning based on the work of Kolb (1984) and a similarly cyclical model of organisational learning formulated by Shaw and Perkins (1992). According to Popper and Lipshitz, the major differences are that organisational learning involves a different form of information processing, and there is the need for dissemination of
knowledge and information throughout an organisation collective (Popper and Lipshitz, 2000, p. 185). Despite the similarity, they contend that a fusion needs to be made between “learning in organisations” (learning occurring in individual heads within an organisation), and “learning by organisations” (learning processes that occur outside of individual heads), if methods of instituting organisational learning are to be realised (Popper and Lipshitz, 2000, p. 184, italics in original source).

The variation in definitions, basic conceptions and viewpoints clearly necessitates a deeper analysis of what organisational learning is. Initially, it seems logical to seek an understanding of what each author understands “learning” to be in the light of the existing categories of individual theories of learning.

2.4 Conceptions of Learning of Organisational Learning

Many authors in the organisational learning field do not directly clarify their understanding of what is meant by the term “learning”, as distinct from the term organisational learning. Below, the inferred or direct understandings of “learning” adopted by authors who have concerned themselves with organisational learning are considered.

Writing from the behaviourist tradition, Levitt and March regard learning as “a process rather than as an outcome” (Levitt and March, 1988, p. 333). They
adopt the position that learning results from direct experience, “learning by doing” (Levitt and March, 1988, p. 321). What is learned and interpreted, and inferred by individuals from particular events or activities is encoded into routines, such as beliefs, frameworks and paradigms, which subsequently determine or guide behaviour (Levitt and March, 188, 319 - 323).

Hedberg (1981) also takes a behaviourist perspective and cites literature that describes a picture of learning as an active process where knowledge is continually updated with either positive or negative consequences, depending on how it is approached (Hedberg, 1981, pp. 4 - 5). While Hedberg mentions trial-and-error and imitation of others’ behaviours as legitimate forms of learning, his emphasis is on stimulus-response models of human learning from experience. Accordingly:

Learners who encounter certain stimuli frequently or who receive important rewards for mastering situations, enrich their knowledge and move towards higher levels of integrative complexity and so improve their maps of the environments and improve their responses to stimuli.

A cognitivist perspective is evident in the position adopted by Fiol and Lyles (1985). The authors initially identify the occurrence of multiple views in the
organisational learning literature of what “learning” is. Learning has been regarded as:

i. new insights or knowledge.
ii. new structures.
iii. new systems.
iv. mere actions, or
v. some combination of the above.

(Fiol and Lyles, 1985, p. 803)

Fiol and Lyles also found that the word “learning” was interchangeably used in the organisational learning literature with “adaptation”, “change”, and “unlearning” (Fiol and Lyles, 1985, p. 803). From their perspective, there are two levels of learning, referred to as lower level learning and higher level learning. Lower level learning is what results from associations built from routines and rules and how they are applied. In contrast, higher level learning refers to a more sophisticated cognitive process than lower level learning, in which learning occurs through “the use of heuristics, skill development and insights” (Fiol and Lyles, 1985, p. 808).

As Huber (1996) generally equates learning with the proper use of explicit quantitative or qualitative knowledge and proper information processing (Huber, 1996, pp. 128 - 129), his underlying cognitivist position is apparent. Similarly, the influence of cognitivism is apparent in the work of Argyris and
Schön (1996). They note that learning may denote something that is learned, such as some form of knowledge or skill, or the process involved in the acquisition of knowledge or skills (Argyris and Schön, 1996, p. 3). Argris and Schön regard learning as a process of explicit observation of incongruities between actions (behaviours) and expected outcomes, which can lead to changes in behaviour. Their perspective on the process of learning is now well known as single-loop and double loop learning (Argyris and Schön, 1996, p. 20 - 21).

Popper and Lipshitz (2000) regard learning as a process of information processing that involves collection, analysis, abstraction and retention (Popper and Lipshitz, 2000, p. 185) which aligns them with the cognitivist tradition. When learning has occurred there are observable changes in organisational activities (Popper and Lipshitz, 2000, p. 184). Huber's (1996) viewpoint on learning also involves the acquisition of explicit quantitative or qualitative knowledge and their use via information processing. However, he highlights that learning is not necessarily conscious or intentional, does not necessarily lead to veridical knowledge or increased effectiveness of individuals, and does not necessarily lead to observable changes in behaviour (Huber, 1996, p.126).

Weick and Roberts (1996) argue that individuals learn by creating social constructs, thereby indicating a leaning towards constructivism. According to Weick and Roberts, individuals’ actions are governed by what they learn through their interrelationships with other individuals and the shared
understandings of their social construct (Weick and Roberts, 1996, p.p. 336 - 337). In a similar vein, Brown and Duguid (1996) also argue that knowledge is socially constructed and distributed collaboratively rather than individual and abstract. In their view, “the central issue in learning is becoming a practitioner not learning about practice”. Therefore, learning is best understood in the context of “the practices and communities in which knowledge takes on significance” (Brown and Duguid, 1996, p. 67 - 70). Cook and Yanow (1996) also allude to the notion that individual know-how is learned in social constructs (Cook and Yanow, 1996, p. 437 - 439), however, they also note that “the study of individual learning is itself complex, in flux, and bounded by its own theoretical constraints” (Cook and Yanow, 1996, p. 436).

It is evident that the organisational learning literature is significantly influenced by individual learning theories that are adopted by the respective authors. A difficulty arises in this regard because each theoretical position produces quite different understandings of what learning is and how it may be judged to have occurred. When organisations are considered as groups of individuals, this in turn draws attention to whether there is a form of group or collective learning that is distinctly different from individual learning, in which case the overlaying of individual learning theories onto organisational constructs would seem inappropriate. It is therefore helpful to next determine what each author believes the learning entity is for organisational learning.
2.5 Learning Entity of Organisational Learning

Central to Argyris and Schön’s (1996) position is the notion that organisational learning results from individuals who regularly have their assumptions tested through explicit collective enquiry, generating a collective understanding of an organisation’s theories-in-use, and that there are subsequent changes in their behaviour which lead to the betterment of an organisation (Argyris and Schön, 1996, p. 16). Therefore, Argyris and Schön see organisational learning as occurring through individual members of an organisation, though they do not regard organisational learning as simply the sum of the individual parts (Argyris and Schön, 1996, p. 6).

Similarly, according to Hedberg (1981), it is the individuals of organisations who learn, not organisations as such (Hedberg, 1981, p. 6). Even so, Hedberg also argues that organisational learning is more than the cumulative result of individual learning. In his view cumulative learning by the organisation becomes part of its fabric such that in the event that there may be staffing changes, ‘organisation’s memories will still preserve certain behaviours, mental maps, norms and values over time’ (Hedberg, 1981, p. 6).

Levitt and March (1988) distinguish between individual and organisational learning by attributing an aggregate, emergent make-up to organisational learning (Levitt and March, 1988, p. 320). Popper and Lipshitz (2000) recognise a need to go beyond individual learning to comprehend
organisational learning because organisational learning occurs outside of individual human heads (Popper and Lipshitz, 2000, p. 184). In fact, Fiol and Lyles (1985) found that there is a general understanding in the literature that organisational learning “is not simply the sum of each members learning” (Fiol and Lyles, 1985, p. 804). They suggest that it is more accurately to do with the organisational cognitive systems and organisational memories that are collectively understood by organisational members (Fiol and Lyles, 1985, p. 804).

Huber (1996) presents a somewhat different perspective to the above by introducing the concept of entity, which includes individuals, groups, organisational sub-units, organisations, industries or society. He therefore moves the unit of analysis away from the individual to include groups of individuals that may contribute to organisational learning (Huber, 1996, p. 126). Weick and Roberts (1996) allude to collective (organisational) behaviour that is distinct from individual actions, thereby suggesting that while individuals learn through their interrelationships an organisation as a whole may learn as a distinct entity (Weick and Roberts, 1993, p. 336 - 337). Cook and Yanow (1996) are also in alignment on this point because they argue that organisational actions are not reducible to individual efforts and that organisations learn in a distinctive way compared to individuals (Cook and Yanow, 1996, p. 437 – 439).
It is evident that there are varying views on what the learning entity is in organisations. It is quite unclear whether organisational learning is about individual learning in organisations, learning that is like individual learning or some type of aggregate of the two.

2.6 Contents and Processes of Organisational Learning

A general overview of Argyris and Schöns' (1996) position is found in Chapter 1 which is expanded upon in the following. At the core of Argyris and Schöns conception of organisational learning are “espoused theories” and “theories-in-use”, together with the notion that organisational learning is “greater than the sum of the learning parts”. Perhaps better known is their distinction between single-loop and double-loop learning that may occur at the individual or organisation level. In the former, there are resultant changes in activities as a result of the detection of performance gaps. In the latter, there are resultant changes in the theory-in-use and then the espoused theory, for example, the underlying norms and values of an organisation (Argyris and Schöns, 1996, pp. 20 – 21). Each organisation member constructs their own representation of an organisation’s theory in use therefore, no individual can have a complete representation of the organisation’s theory-in-use. At best, an individual can attempt to complete the representation by observing their activities in relation to their interactions with others (Argyris and Schöns, 1996, p.15). Argyris and Schöns developed the distinction between single-loop and double-loop learning because double-loop learning refers to the necessity,
at times, to modify individual and organisational values and norms (existing perspectives, interpretation frameworks, decision-making premises) as a result of changes in the environment in which an individual or organisation functions (Argyris and Schön, 1996, pp. 22 - 25).

There is a practical component to Argyris’ and Schön’s (1996) approach to organisational learning called “action science” (Argyris and Schön, 1996, p. 50). This component particularly aims to overcome hindrances to double-loop learning by accessing individual theories-in-use. The general approach is to access publicly and scrutinise organisation member’s ways of “getting-the job-done”, their theories-in-use, in facilitated group discussion settings. Useful new information that becomes apparent is then used to contribute to double-loop organisational learning (Argyris and Schön, 1996, pp. 111 - 121). Such learning may involve discarding obsolete theories-of-action and theories-in-use, a process that has come to be known as “unlearning” (Argyris and Schön, 1996, p. 3).

A specific type of double-loop learning, at both the individual and organisational level, is the notion of learning how to learn, or deuterolearning. Argyris and Schön (1996) regard deuterolearning as vital for it can provide the means by which the organisation can modify the ways in which it learns through its learning system, which includes the structures and behaviours that facilitate or inhibit organisational enquiry (Argyris and Schön, 1996, p. 28 - 29). At the crux of successful double-loop organisational learning is the need
for the organisation members to have values, behavioural strategies and social virtues that will reduce the degree of defensiveness in organisational players when their assumptions are publicly scrutinised (Argyris and Schön, 1996, p. 119 - 120). As part of the learning process, as Argyris and Schön (1996) have argued, it needs to be recognised that when organisational learning is understood to be what results in the change of theories-in-use, the change may subsequently be shown to be based on a falsehood. In these circumstances, the outcome has been described in the literature as “superstitious learning” (Argyris and Schön, 1996, p. 19).

Within a situation promoting experimentation, Hedberg (1981) argues that learners can understand, create and master their own environments through both adaptive and manipulative behaviour. He suggests that to be most effective a learning situation needs to be an open, cognitive system that has a balance of change and stability, and includes feedback mechanisms that can bring about changes in knowledge or the system itself (Hedberg, 1981, p. 5). Organisations and individual members are in a state of continuous interaction, including learning, however. Hedberg notes this as an area that has received scant attention in research (Hedberg, 1981, p. 7). The importance of understanding the interaction between individuals and their organisational entity relates to the belief that it is possible that organisations know less than their members due to the common problems associated with communication (Hedberg, 1981, p. 6). Like Argyris and Schön (1996), Hedberg points to the need for a greater understanding of how individual learning can be harnessed
and transmitted into an organisation in a usable form and vice versa (Hedberg, 1981, p.6).

While Hedberg (1981) mentions trial-and-error and imitation of others' behaviours as legitimate forms of learning, his emphasis is on stimulus-response models of human learning from experience (Hedberg, 1981, p. 7). He extends his argument to include complexity theory which maintains that a particular stimulus in complex situations can bring about completely different responses from individuals when compared to groups. The difference is accounted for by the dissimilarity in perception of individuals and groups. Perceptive ability can range from single dimension to multidimensional perspectives that can lead to different outcomes. Groups may adopt a more multidimensional perspective because of the range of inputs possible. A multidimensional perspective means that stimuli are passed through more complex perceptual filters. Consequently, more alternatives can be considered and less naïve responses to stimuli are to be expected from individuals and organisations. Hedberg recognises that perceptions are the result of the filtering of stimuli from the real world. The particular difficulty, Hedberg contends, is that not much is known about how organisational perceptual filters arise or how organisations interpret their environments (Hedberg, 1981, p.8). According to Hedberg (1981):

Learners who encounter certain stimuli frequently or who receive important rewards for mastering situations, enrich their
knowledge and move towards higher levels of integrative complexity and so improve their maps of the environments and improve their responses to stimuli.


Hedberg (1981) extrapolates the stimulus-response and complexity theoretical positions to organisational learning. He argues that the theories-of-action expounded by Argyris and Schön (1996) are “for organisations what cognitive structures are for individuals” (Hedberg, 1981, p.7). In Hedberg’s view, organisations interpret stimuli from their environments through their theories-of-action before formulating a response. Such learning may range from single-loop learning to double-loop learning terminology (Hedberg, 1981, p. 8) and the learning cycles may be complete or incomplete (Hedberg, 1981, pp. 9 - 12).

If the stimulus-response model of learning is taken as a given, Hedberg assumes that unlearning in organisations is similar to unlearning in individuals (Hedberg, 1981, p. 19). He describes the process of organisational (and individual) unlearning in three steps: i. unlearning the world-view, ii. disconfirmation of the relationship between a given stimulus and response, and, iii. disconfirmation of the relationship between known responses. In effect, the theories-of-action that exist are put to the test. Using Hedberg’s notion of complete and incomplete unlearning cycles (Hedberg, 1981, p.19), and the argument in the literature that he cites suggesting that organisations
are generally regarded as highly resistant to change (Hedberg, 1981, p. 18), the result of attempts of unlearning may be that the organisation unlearns but individuals do not, or vice versa (Hedberg, 1981, p. 19). Specifically referring to “learning about organisational learning”, Hedberg promotes the need for a better understanding of the relationship between individual and organisational learning (and unlearning) or the development of specific theories on how organisations learn. There is also the need for determining how organisations shift their theories-of-action, that is to say, how they learn, unlearn and relearn (Hedberg, 1981, p. 20).

Fiol and Lyles (1985) argue that “organisational performance affects the organisation’s ability to learn and to adapt in a changing environment” (Fiol and Lyles, 1985, p. 804). According to Fiol and Lyles, learning is more likely to occur in organisations that promote a culture (shared beliefs, ideologies, patterns of behaviour) favourable to learning, have strategies that aid perception and interpretation and yet are flexible, provide a decentralised structure which tends to encourage innovation, and have created the right balance of stability and change with their internal and external environments (Fiol and Lyles, 1985, pp. 804 - 805).

Central to seeking the development of a better theory of organisational learning, Fiol and Lyles give particular attention to examining the concept of learning because “the organisational literature is full of multiple interpretations of the concept” (Fiol and Lyles, 1985, p. 805). They conclude
that there are two main facets to organisational learning that are regularly alluded to in the literature. The first facet is the content of organisational learning. This may be "the patterns of cognitive associations developed by the organisation’s members" or "the behavioural outcomes that reflect the patterns and/or cognitive associations that have developed" (Fiol and Lyles, 1985, p. 806). In Fiol and Lyle’s view, behaviour and cognition are distinct forms of content since the obtaining of new knowledge does not necessarily lead to changes in behaviour, and changes in behaviour do not necessarily mean that new knowledge has been gained. To demonstrate the distinctiveness of cognition and behaviour in an organisational sense, Fiol and Lyles (1985) consider examples such as a well established company with a dominant position in the marketplace that may well obtain new knowledge but have no necessity to bring about any changes to its strategies. In contrast, a company involved in a tumult of mergers and acquisitions may blindly adopt behaviours in the hope that something will bring about a positive outcome. In other words, the behaviour is not the result of new knowledge about what may bring about a desirable outcome (Fiol and Lyles, 1985, pp. 806 - 807). Fiol and Lyles argue that: “Making organisational changes or adjustments does not and should not automatically assume the existence of learning” (Fiol and Lyles, 1985, p. 810). However, the authors suggest possible strategies that give emphasis to organisational cognitive development or organisational behavioural development depending on the environmental conditions of a particular organisation (Fiol and Lyles, 1985, p. 806 – 807).
Besides behaviour, the second facet to organisational learning “refers to the extent of cognitive development” and “the level at which this development takes place” (Fiol and Lyles, 1985, p. 806). Thus, in Fiol and Lyles view, there are two levels of learning, referred to as lower level learning and higher level learning. Lower level learning is what results from associations built from routines and rules and how they are applied. Higher level learning in contrast refers to a more sophisticated cognitive process than lower level learning, in which learning occurs through “the use of heuristics, skill development and insights” (Fiol and Lyles, 1985, p. 808). Unlike lower level learning, higher level learning has the capacity to bring about changes to an organisation’s memory, or theories-in-use, and may include unlearning. Fiol and Lyles argue that there are times when higher level learning can become dysfunctional, to the point that the learning can involve adopting stances that thwart the behaviours or actions that are required to ensure the survival of an organisation. In this case it would appear that some crisis may provoke the need for new higher level learning, unlearning or readaption (Fiol and Lyles, 1985, p. 808). According to Fiol and Lyles, there are a range of difficulties that need to be overcome before the development of a theory of organisational learning can progress. There is a need to:

i. reach agreement about the meanings of words used,

ii. behavioural and cognitive development must be considered as different facets of organisational learning,
iii. develop methodologies for measuring types of organisational learning, and

iv. develop methodologies for measuring lower level- and higher level- organisational learning that go beyond observations of changes.

(Fiol and Lyles, 1985, p. 811).

Levitt and March (1988) regard learning as an important basis for organisational intelligence (Levitt and March, 1988, p. 333 - 336). In their view, what is learned is encompassed in organisational routines. They clarify that organisational routines include “forms, rules, procedures, conventions, strategies, and technologies”; together with “beliefs, frameworks, paradigms, codes, cultures, and knowledge that buttress, elaborate, and contradict the formal routines”. They argue that routines develop as a result of experiential lessons that are recorded in the collective memory of an organisation. The routines are transmitted throughout an organisation in the course of its everyday functioning. Such routines can change as a result of direct organisational experience, including interactions with other organisations, and interpretations of past experience. (Levitt and March, 1988, p. 320).

Levitt and March (1988) use the manufacturing industry, in which cumulative experience and feedback has been shown to lead to improved production skills, to demonstrate direct learning or “learning by doing”, including trial-and-error learning. They report on some sophisticated empirical studies that
suggest the observed improvement is greater than the sum of the contributing factors, such as the increased experience of workers or new technology (Levitt and March, 1988, p. 321). Levitt and March suggest that this can be explained by the "multilevel learning" that occurs in organisations. "In such multilevel learning, organisations learn simultaneously both to discriminate among routines and to refine the routines by learning within them" (Levitt and March, 1988, p. 322) thereby increasing the ability of the organisation to increase its procedural efficiency and competence. However, there are also situations where it is possible for an organisation to adopt a mediocre procedure, in which the outcome has been judged to be advantageous, and become competent in that. In such situations, Levitt and March argue that it can be difficult for organisations to change the established mediocre procedures even though serious consequences can arise as a result (Levitt and March, 1988, pp. 322 - 323).

According to Levitt and March (1988) organisations can also learn from interpreting experiences and rating them as having produced positive or negative outcomes (Levitt and March, 1988, p. 323). They contend that such organisational interpretation of experience results from an aggregate of individual construal and collective understandings of organisational history. Consequently, broadly shared constructs of organisational experience and organisational history can provide a framework in which learning occurs and routines are changed, through double-loop learning as described by Argyris and Schön (1996) for example. However, Levitt and March also suggest that
the outcomes of organisational interpretation of experience are likely to be inexact. Individual interpretations for example, tend to be coloured by perceived intents of other individuals, or overly simplified cause and effect rules of association (Levitt and March, 1988, p. 323). Similarly, organisational interpretation of experience may be directly prejudiced by influential individuals or groups within an organisation and their ability to sway the collective view (Levitt and March, 1988, p. 324). Levitt and March argue that learning from experience is further complicated by the configurations of individual and organisational interpretations of success and failure that do not necessarily align, and the influence that “superstitious learning” has in promoting misunderstandings (Levitt and March, 1988, p. 324 - 325).

According to Levitt and March (1988), organisational learning depends on individual and organisational aspects of memory (Levitt and March, 1988, p. 326). They regard organisational memory as a construct of declarative experiential knowledge, such as would be found in files and operating procedures, and tacit experiential knowledge such as in the unofficially accepted way of “doing things”. While it may be possible to convey much of this knowledge “under many circumstances” (Levitt and March, 1988, p. 328), Levitt and March also argue that not all organisational experience is recorded or preserved due to the constraints inherent in organisational structures (Levitt and March, 1988, p. 328). They argue further, that of the organisational routines that are retrievable from the memory of the organisation, those that have been used recently, regularly and consistently are more accessible,
particularly where they also link directly to specific responsibilities in the organisation (Levitt and March, 1988, pp. 328 - 329). While Levitt and March recognise the value of information technology systems in some knowledge retrieval situations, they argue that the systems have difficulty in taking into account the particular foibles or strengths of an organisation. “As a result, they are likely to make learning more difficult for the organisation” (Levitt and March, 1988, p. 329).

Levitt and March (1988) posit that theories of routine-based learning need to take into account how organisations learn from other organisations’ successes and failures (Levitt and March, 1988, p. 329 - 330). While commercial-in-confidence knowledge clearly has a more restricted application in knowledge dissemination (Levitt and March, 1988, p. 331), they identify some processes by which knowledge may be disseminated among organisations, for example, rules of governing or representative bodies, deliberate contacts between organisations or the engagement of consultants, or organisational personnel bring new knowledge into the organisation and disperse it. On the other hand, organisations may simply attempt to imitate the practices of other organisations with either positive or negative outcomes (Levitt and March, 1988, pp. 330 - 331).

“Relatively simple conceptions of learning become complex” (Levitt and March, 1988, p. 331) because organisations learn within an environment containing other organisations that are learning. Levitt and March (1988)
argue that one organisation’s action can have effects on the functioning of another organisation, therefore the learning of any organisation is dependent on the “skills and abilities” of its cohabiting organisations (Levitt and March, 1988, p. 332). Related to this is an organisation’s ability of “learning to learn” such as occurs when a “weaker organisation” has to adapt to experiencing the effect of a “dominant organisation”. However, the reverse situation is less likely (Levitt and March, 1988, p. 332) and in any case, “learning does not always lead to intelligent behaviour” (Levitt and March, 1988, p. 335).

In general, Huber (1996) regards organisational learning as the proper use of explicit quantitative or qualitative knowledge, from both internal and external sources to the organisation, and proper information processing. While he acknowledges that there is a tendency to use the words “knowledge” and “information” interchangeably he argues that there is some distinction between the two. Knowledge is the more complex in content whereas information tends to provide for clarification (Huber, 1996, footnote, p. 153). Huber analyses the literature from the constructs of knowledge acquisition (the obtaining of information), information distribution (the sharing of information and development of new understandings), information interpretation (distributed information is given one or more commonly understood interpretations) and organisational memory (the means by which knowledge is stored for future use).
It is via the wide distribution of information to organisational members and organisational subunits, collected in the ways described above, that Huber argues learning is more likely to occur (Huber, 1996, p. 141). He suggests this is to be expected because organisational subunits can expound new information from combining information received from other areas of an organisation. The information is more likely to be accessible if it has been widely distributed and is a necessity for organisational learning that involves interpretation of the information (Huber, 1996, p. 141 - 143). Huber argues that the extent of learning is directly related to the number of interpretations developed:

...because such development changes the range of the organisation's potential behaviours, and this is congruent with the definition of learning. It also seems reasonable to conclude that more learning has occurred when more of the organisation's units understand the nature of the various interpretations held by other units.

(Huber, 1996, p. 143).

In considering the collective interpretation of new information Huber (1996) specifies several likely areas that act as determinants of outcomes.

i. the uniformity of prior cognitive maps possessed by organisational units.
ii. the uniformity of the *framing* of the information as it is communicated,

iii. the *richness of the media* used to convey the information.

iv. the *information load* on the interpreting units, and

v. the amount of *unlearning* that might be necessary before a new interpretation could be generated.

(Huber, 1996, p. 144, italics in original source).

Thus, Huber draws attention to the fact that the mental representations possessed by individuals and organisational units will determine how information is interpreted. Where there are differences in mental representation, or if information is provided in different ways to different entities, then the risk of a range of non-uniform interpretations by entities is likely to be much higher (Huber, 1996, p. 144). On this basis, Huber explores how the ways in which information can be given common meaning through appropriate medium. However, he also notes there is an argument that a collective interpretation of information is not required for organisational units to agree on action – to the point that “ambiguity facilitates agreement on actions” (Huber, 1996, p. 145).

According to Huber (1996), “unlearning” for the most part denotes a “decrease in the range of potential behaviours, rather than to indicate a qualitatively different process” (Huber, 1996, p. 147). Unlearning may mean that some form of knowledge becomes inactive, substituted for, or the
opportunity for new learning is made available (Huber, 1996, p. 147). Huber argues that the processes that contribute to organisational learning are dependent on memory, for that reason there is a large amount of organisational information contained in operating procedures and routines for example. However, there is a lesser body of knowledge concerning the role that non-routine organisational information has in organisational behaviour (Huber, 1996, p. 149). Huber suggests that this may be understood in terms of the amount of tacit knowledge that may vanish in the event of the removal of an individual or organisational entity (Huber, 1996, p. 148). "Hard knowledge" can be stored on computers as a form of organisational memory however the storage of "soft knowledge", that which is only found in the brains of individuals, is not so easily collected and stored for future use (Huber, 1996, p. 149 - 150). As a result of his analysis, Huber concludes that a lack of conceptual, cumulative, integrative and empirical research work concerning organisational learning has contributed to the lack of agreement on what organisational learning is. Even so, he posits that "the topic of organisational learning is intellectually attractive and of practical importance" (Huber, 1996, p. 152).

Weick and Roberts (1996) illustrate their conception of collective mind through the analysis of flight operations on aircraft carriers. The carriers are regarded as good examples because the aim is to have them operate without error, whatever their circumstances (Weick and Roberts, 1996, p.p. 330 - 331). In considering the concept of mind, Weick and Roberts argue that
“mind” is a disposition to heed (or not heed) before undertaking an action or behaviour, a process in which an individual continues to learn (Weick and Roberts, 1996, p. 336). They expand this view to a group scenario by considering the properties of group performance, whereby individuals create a social construct in which their collective behaviour is a result of their interrelationships, the shared understanding of the group, and an understanding of what causes the actions of each other (Weick and Roberts, 1996, pp. 336 - 337). From this base, they derive the conception of collective mind, where actions and behaviours are a convergence of continually changing individual views in response to a jointly, and similarly, perceived situation, the envisaged system (Weick and Roberts, 1996, pp. 339 - 340). Each individual, Weick and Roberts argue, will not have a complete representation of the envisaged system and that this demonstrates the “transindividual quality of collective mind” (Weick and Roberts, 1996, p. 346) or, put another way, the notion of distributed cognition (see Chapter Seven).

The effectiveness of collective mind is dependent on the degree of heed that exists in the interrelationships of individuals. The effectiveness can be increased by ensuring the existence of interconnections to history, interconnections between activities and interconnections between levels of experience, according to Weick and Roberts (1993, pp. 340 - 341). In their view, the greater the interconnectedness, the greater the collective mind understanding and the fewer the errors that are likely to occur (Weick and
Roberts, 1996, p. 341). In a situation where there is a necessity to overcome variations in heed, Weick and Roberts (1996) suggest the use of experienced “insiders”, who have exceptional narrative skills, to aid the socialisation of “inexperienced newcomers” (Weick and Roberts, 1996, p. 342). The authors argue that stories help individuals to recognise similarities in situations in which they may find themselves. Thus, narrative skills:

...are important for collective mind because stories organise know-how, tacit knowledge, nuance, sequence, multiple causation, means-end relations, and consequences into a memorable plot. The ease with which a single story integrates diverse themes of heed in action foreshadows the capability of individuals to do the same. A coherent story of heed is mind writ small. And a repertoire of war stories, which grows larger through the memorable exercise of heed in novel settings, is mind writ large.

(Weick and Roberts, 1996, p. 343).

According to Weick and Roberts (1996), this serves to demonstrate the important role experienced insiders may have in facilitating or not facilitating a newcomer’s ability to avoid making mistakes. Even so, Weick and Roberts allude to wider issues and analyse a range of interactions, or lack of them, that have the potential to undermine the retention of, or conveying of “dispositions of heed” within groups (Weick and Roberts, 1996, p. 343 - 349).
Weick and Roberts (1996) argue that it is important to separate the development of mind from the development of a group and insinuate that collective mind is a distinct process in social life. They use examples of groups with varying combinations of developed or undeveloped groups, with developed or undeveloped collective mind (Weick and Roberts, 1996, p. 350 - 351). They further argue that this view changes the way in which “group development” should be construed because a well functioning group mimics the same behaviour observable in a newly forming group, however, the mimicry can be lost with the passage of time (Weick and Roberts, 1996, p. 351). Consequently, the necessity for a group’s survival involves reassessing their modes of interrelating throughout their history (Weick and Roberts, 1996, pp. 351 - 352).

In concluding, Weick and Roberts (1996) briefly extrapolate their theory of collective mind and heedful interrelating into conceptualisations of organisational theory and practice. (Weick and Roberts, 1996, pp. 352 - 355). They suggest that the concept of collective mind may provide a tool for comparative analysis or performance appraisal (Weick and Roberts, 1996, p. 353). Further, that it is the degree of interrelating, including interpersonal skills, that determines the level of reliability of an organisation. Where interrelating is continual and concentrated high-reliability organisations are formed (Weick and Roberts, 1996, p. 354). According to Weick and Roberts, high-reliability organisations are those that are “thoroughly social” and therefore “reliable performance may require a well-developed collective mind
in the form of a complex, attentive system tied together by trust” (Weick and Roberts, 1996, p. 351).

Brown and Duguid (1996) use an ethnography study of service technicians (see Orr [1996], for the original published version of the study). The technicians work in a large corporation, to demonstrate the variance between espoused practice and actual practice. The corporation provides technicians with service manuals that reduce complex tasks to simple prescriptive steps, such as a decision tree, on the assumption that there is no need for special training or understanding of technically sophisticated machines. The reality is that the technicians find that they must innovate to solve problems and yet the corporation interprets such action as deviant behaviour. Brown and Duguid argue that managers have a conceptual framework of the technicians’ work, through formal job descriptions, that does not allow the managers’ comprehension of the important practical aspects of servicing work. Not surprisingly, this results in a tension between managers and technicians, for on paper the technicians are down skilled and yet in practice they undertake increasingly complex tasks requiring greater improvisation (Brown and Duguid, 1996, pp. 58 - 61). Thus the technicians:

...develop their understanding of the machine not in the training programs, but in the very conditions from which the programs separate them – the authentic activity of their daily work. For the
reps (and for the corporation, though it is unaware of it),

learning-in- workings is an occupational necessity.


The central features of work practice demonstrated in the ethnographic study, according to Brown and Duguid, are narration, collaboration and social construction. They argue that individual learning is thus inseparable from collective learning. Accumulated knowledge is socially constructed and distributed and technicians develop their own identity and, simultaneously, that of the emergence of the community in which the technicians work. Importantly this is in direct contrast to the implied corporate view that learning is individual and abstract, and that any sense of a collective is generally not acknowledged (Brown and Duguid, 1996, pp. 64 - 68).

Brown and Duguid (1996) posit that “the central issue in learning is becoming a practitioner not learning about practice”. Thus, learning is best understood in the context of “the practices and communities in which knowledge takes on significance” (Brown and Duguid, 1996, p. 69 - 70). While recognising the complexity of fostering learning-in-work, they suggest that at the crux is the full recognition of practices within communities and the need for learners to have legitimate access to the periphery of practice (Brown and Duguid, 1996, pp. 71 - 72). Given that large organisations may be conceived as a collective of communities that may be given the opportunity to interchange their particular perspectives on issues relevant to the benefit of the organisation as a
whole ("the community-of-communities"), Brown and Duguid argue that there is scope for designing organisational structures that enhance such interaction. In spite of the problems that may result from a rearrangement of traditional organisational structures in respect of communities-of-practice, Brown and Duguid infer that there are likely to be benefits also (Brown and Duguid, 1996, pp. 77 - 79).

In the vein of Brown and Duguid, Cook and Yanow (1996) offer a quite different perspective on organisational learning compared to the previous authors. They argue that in most cases, authors who consider organisational learning "examine how individuals learn in organisational contexts or have explored ways that theories of individual learning can be applied to organisations or both" (Cook and Yanow, 1996, p. 431). In particular, Cook and Yanow suggest that most accounts of organisational learning are significantly influenced by theories of individual cognition, to the point that organisations are conceptualised as "individuals" that learn in a way described by those theories. Hence, it is a common suggestion in the literature that observable changes in the way an organisation conducts its activities is evidence of organisational learning having occurred and that organisational learning is essentially the result of the learning of individuals within an organisation (Cook and Yanow, 1996, pp. 431 - 436). However, Cook and Yanow identify that there are instances of learning in which there is no observable change in behaviour, and where there are changes in behaviour
they are not necessarily equated with improvement in organisational functioning (Cook and Yanow, 1996, pp. 436 - 437).

Cook and Yanow (1996) are critical of the “error detection and correction” models of organisational learning. In their view, such a model has resulted from the systems view of organisations with an overlap of the cognitive perspective of learning, resulting in a purely problem-resolution outlook on organisational learning. In effect, an emphasis develops on what is going wrong to the exclusion of what is going right in an organisation (Cook and Yanow, 1996, pp. 454 - 455). Taking the position that individuals do learn in organisational contexts and may consequently influence the activities of an organisation, Cook and Yanow give a cultural perspective to organisational learning. A main contention is that a clear distinction must be made “between learning in organisations and learning by organisations” (Cook and Yanow, 1996, p. 452, italics in original source). They argue that organisations can learn as an entity in ways that are distinct from those ascribed to individual learning. Organisations are groups of people and Cook and Yanow argue that what organisations do can only be attributed to the organisation as a whole, not to individual employees. Accordingly, they posit that the actions of organisations are not reducible to the individual efforts of employees; the actions are always a group activity. For example:

The know-how entailed in producing a computer, a Saab 9000, or a set of standards for air quality resides in the organisation as a
whole, not in the individual members of the organisation. These are propositions about organisational knowing.

(Cook and Yanow, p. 438).

Cook and Yanow (1996) extrapolate the notion of organisational knowing to organisational learning by recognising that the individuals in an organisation have to learn the particular aspects of their job, and that an organisation initially does not have the ability to produce its particular outcomes, in effect the organisation must learn as an aggregate. The critical difference, according to Cook and Yanow, is that attributing cognitive activity as might be done for individuals to organisations is meaningless (Cook and Yanow, 1996, pp. 438 - 439). In their view a more productive direction is to link organisational learning to organisation culture which means:

…values, beliefs, and feelings, together with the artefacts of their expression and transmission (such as myths, symbols, metaphors, rituals), that are created, inherited, shared, and transmitted within one group of people and that, in part, distinguish that group from others.


Cook and Yanow (1996) support their contention through a consideration of the operations of several organisations that manufacture flutes that are highly regarded by musicians throughout the world. It is demonstrated that each of
the organisations produce flutes that are the result of group effort and the knowledge required has been learned collectively. Only the organisations as whole entities can produce their distinctive flutes. Even in the event of the loss of an individual employee, the same quality and style are maintained within a particular organisation because the know-how resides in the organisation not the individual. Indeed, it is not possible for an individual to use the entire organisational knowledge to produce a flute by themselves. In effect there is uniqueness about the respective flutes produced by the different manufacturing organisations explainable only by the tacit learning of the judgement of "feel" and "look" of instruments, attributable to a specific organisational context. In such contexts there may be observable and non-observable changes (Cook and Yanow. 1996, pp. 440 - 448). Consequently, Cook and Yanow argue:

...such organisational learning is better explained from a cultural perspective that assumes the group and group attributes as its unit of analysis than from an individually oriented cognitive perspective.

(Cook and Yanow, 1996, p.445)

Notably, Cook and Yanow conclude that much of organisational learning is tacit, acquired through the "normal" course of events of the operations of a particular organisation and the subsequent interaction with artefacts of an organisation's culture, for example, meaningful organisational objects,
language and acts. In contrast to the cognitive organisational learning perspective that purports that what is to be learned needs to be explicit, the cultural organisational perspective also encompasses tacitly acquired knowledge that is communicated and understood indirectly (Cook and Yanow, 1996, pp. 449 - 450). This leads Cook and Yanow to encourage the inclusion of noncognitive aspects of human action and organisational culture into the conception of organisational learning (Cook and Yanow, 1996, p. 453).

According to Popper and Lipshitz (2000), collective-level hypothetical constructs, such as the organisational theories-of-action constructed by Argyris and Schön (1996), may provide a mechanism for fusing learning in organisations and learning by organisations. However, in their view such constructs are flawed in that they cannot be empirically proven to exist (Popper and Lipshitz, 2000, p. 184). Consequently, they suggest what they consider to be superior fusing mechanisms in the form of “institutionalised structural and procedural arrangements that allow organisations to learn non-vicariously. In other words, organisations may collect, analyse, store, disseminate, and use systematically information that is relevant to their and their members’ performance” (Popper and Lipshitz, 2000, pp. 184 - 185). Popper and Lipshitz allude to lower and higher levels of organisational learning by describing an approach that uses “organisational learning mechanisms” that can be classified according to how, when, and by whom they are enacted (Popper and Lipshitz, 2000, p. 185). For example, there are mechanisms that endorse organisational learning in the course of task
performance, and others that involve the assigning of organisational learning to specialists who are somewhat removed from the operational level such as strategic planning units (Popper and Lipshitz, 2000, p. 185). From the perspective of Popper and Lipshitz, organisational learning mechanisms can be likened to the biological system that allows individuals to learn, and may produce varying degrees of productive outcomes (Popper and Lipshitz, 2000, p. 185).

In relation to the question of whether organisational learning is likely to be productive overall, Popper and Lipshitz (2000) suggest that this tendency has a high probability in an organisational culture that includes organisational values such as continuous learning, valid information, transparency, issue orientation and accountability (Popper and Lipshitz, 2000, pp. 186 - 189). In fact, Popper and Lipshitz (2000) argue that a combination of their structural notion of “organisational learning mechanisms” and organisational culture provides an avenue for empirically determining whether an organisation is “a learning organisation” (Popper and Lipshitz, 2000, p. 192). According to the authors, organisations that have the values they describe are rare which leads them to consider the factors that are likely to promote organisational learning. Based on their analysis of empirical studies of organisational learning, Popper and Lipshitz argue that at least some of the following factors must be present for organisational learning to occur: “a high level of environmental uncertainty, costly potential errors, a high level of professionalism, and strong leadership commitment to learning” (Popper and Lipshitz, 2000, p. 189). They
conclude that their overall analysis provides direction for empirical research rather than authoritative solutions concerning controversial issues in organisational learning (Popper and Lipshitz, 2000, pp. 189 - 191).

2.7 General Themes and Contentious Issues

While it is customary to provide an accepted definition at the beginning of a work that is to offer critical comment, Thagard (1998) argues that a different approach may be required in particular circumstances. In his view, it is often difficult to arrive at definitions that exactly encapsulate what is meant, except perhaps in physics and mathematics. Given the fragmented and differentiated contributions in organisational learning it does not seem possible to give a precise definition. Thagard argues that in such circumstances it is appropriate to think in terms of concepts, which he describes as “frames, schemas or scripts” that exist purely in a mind/brain and develop through sensory experience and other concepts. At the conclusion of a line of inquiry into a concept, it may possibly be definable, however, this may not necessarily be desirable or required especially where strict rules do not apply (Thagard, 1998, pp. 59 - 60).

As has been demonstrated in the survey of organisational learning literature above, there is little agreement on what constitutes organisational learning or how it is to be conceptualised. It is not surprising that there is an assortment of definitions of organisational learning when there is not even clear agreement
on what learning is. The foregoing suggests that the main issues concerning organisational learning are:

i. Conceptions of organisational learning tend to reflect individual learning theories, which may not be appropriate.

ii. The wide variation in definitions of organisational learning.

iii. The assumptions made as to what constitutes organisational learning.

iv. The varying views on what is learned, either individually or collectively, and whether it is consciously extractable and capable of being articulated in an explicit way, such as through behaviours, policies, rules, routines.

v. Whether individuals are the unit of analysis, or whether organisations (collectivities) as entities in themselves are the unit of analysis.

vi. The various positions adopted on what is learned in organisational learning.

vii. The lack of clarity as to when learning takes place in organisations.

viii. The perceived benefits of learning in organisations.

ix. The lack of understanding as to how learning takes place in organisations.
There are, however, points of agreement or recurring themes in the organisational learning literature such as:

i. Learning is useful.

ii. Organisations (or collectivities) learn.

iii. Learning occurs throughout organisations.

iv. Learning involves implicit and explicit factors.

v. Learning involves contextual (environmental, social, situational) factors.

vi. Collaboration of individuals to achieve organisational purpose is complex.

vii. Individual learning is not the same as organisational learning.

viii. Individual knowledge is not the same as organisational knowledge.

Table 1. on page 79 demonstrates the variation in conceptions of organisational learning considered in this chapter. Most notable is that conceptions of organisational learning are largely based on implied views of the nature of knowledge and learning that tend to emphasise what can be consciously extracted and articulated by individuals. Overall, there is an uncertainty about learning and scant attention is paid to it. There is no clear explanation established as to how learning may occur implicitly and explicitly in individuals and organisations. In the “error detection and correction”
conceptions of organisational learning, particularly in the application of some form of interventionist “organisation development program”, there would seem to be a tendency to assume that tacit knowledge may also be explicitly described.

Given the range of issues and assumptions made concerning learning and organisational learning at the theoretical level it is reasonable to suggest that it is the lack of attention given to learning, in particular, that has contributed significantly to the concept of organisational learning lacking clarity.

Consequently, the majority of the following Chapters are concerned with contemporary understandings of learning, both individual and collective. However, before embarking on a detailed consideration of “learning” in later Chapters, Chapter 3 describes a variety of empirical investigations that have contributed to current understandings of organisational learning from a practical viewpoint.

2.8 Summary

This Chapter has demonstrated that authors who have proposed theoretical conceptions of organisational learning are readily influenced by various theories of individual learning. It has also shown that there is wide variation in: definitions, general frameworks and viewpoints; what constitutes the learning entity in an organisation; the content of learning; and the processes of
learning. While there are some areas of general agreement about organisational learning, the wide variation in key conceptual factors as described above, in particular what constitutes "learning", have led to a range of contentious issues that have not been addressed.
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Chapter Three:

Empirical Investigations of Organisational Learning

3.1 Introduction

The consideration of the variety of theoretical frameworks that have influenced organisational learning in Chapter Two is but part of the picture. A number of authors have bemoaned the shortage of empirical studies of organisational learning (Fiol and Lyles, 1985, pp. 811; Huber, 1996, pp. 152 - 153). In surveying the literature it is noticeable that the number of authors who adopt a practical approach to organisational learning is considerably less than those who take a theoretical/descriptive approach. Nevertheless, the practical nature of empirical studies provide a different perspective and an important “experiential” component to the understanding of organisational learning.

This Chapter provides an overview of a selection of empirical investigations that are intended to add to the current understanding of organisational learning. The investigations also demonstrate the uses applied to organisational learning and the complexities involved in studying organisational learning. It will be noticed that the authors have a tendency to make assumptions about “learning” as it may apply to organisational learning. Many of the authors appear to have a predisposition to stress the link of
organisational learning to "performance improvement" and a "top-down management tool". In contrast, other authors equate organisational learning with evolutionary processes that operate under particular circumstances. Hence, it is argued that empirical investigations of organisational learning raise the same issues as the theoretical accounts of organisational learning considered in Chapter One rather than clarifying the issues.

3.2 Empirical Investigations

3.2.1 Attitude of Managers to Learning

Antonacopoulou (1999, pp. 217 - 242) conducted a longitudinal case study of seventy-eight managers in three retail banks to determine what characterised and determined the negative or positive attitudes of managers towards learning. The interdependence of individual learning and organisational learning was demonstrated. For example the learning strategies of the majority of the managers were found to centre on avoiding failure, and aligning themselves "safely" with the direction and image they perceived was being promulgated by their respective organisations (Antonacopoulou, 1999, p. 238). The "safe" approach to learning restricts individual learning, and consequently organisational learning is restricted by seeking to control the learning of individuals. In situations where learning becomes politicised, such as may occur in performance reviews, Antonacopoulou suggests that negative
perceptions and feelings develop (Antonacopoulou, 1999, p. 237). The outcomes of Antonacopoulou’s study insinuate that more investigation is needed into the interconnectedness of individual and organisational learning, the impact of implicit and explicit organisational edicts, issues of context and how “learning managers” can facilitate organisational learning (Antonacopoulou, 1999, p. 242).

3.2.2 Training Managers for Organisational Learning

An in-depth case study of the “transformation” of the public sector Swiss Postal Service to a “learning organisation” is provided by Finger and Brand (1999, pp. 130 - 156). The transformation was initiated by the Postal Service in response to an urgent need to respond to a significantly changed environment. Finger and Brand argue that in the case of public sector organisations

...the creation of a learning organisation must be seen as a process of organisational change and profound organisational transformation, involving culture, structure and, most importantly, the organisation’s relationship to its political environment. Therefore, a set of interventions cannot be sufficient.

(Finger and Brand, 1999, p. 140).
As distinct from cognitive and humanistic conceptions of learning, they suggest that a pragmatic conception of learning, in the sense of "learning from experience" theory attributed to John Dewey, is the most appropriate (Finger and Brand, 1999, pp. 137 - 140). In pragmatic organisational learning, Finger and Brand argue that individual learning occurs through an "experiential learning cycle", group learning occurs through a "collective learning cycle", and an organisation provides the conditions for fostering the "collective learning cycle" (Finger and Brand, 1999, p. 139).

In general, Finger and Brand found that the provision of training and other learning initiatives to top managers was insufficient to bring about the desired transformation. At best, an atmosphere supportive of collective learning was developed, and the obstacles to becoming a learning organisation were identified (Finger and Brand, 1999, 144 - 146). Consequently, Finger and Brand suggest four areas that need further attention if the concept of a learning organisation is to develop further. First, there is a need to improve the understanding of the relationship between individual learning and collective change, and how learning and organisational change are linked. Second, the explicit link between individual and collective learning and organisational goals need to be established rather than assumed. Third, "...the capacity of an organisation to learn...to function like a learning organisation... needs to be made more concrete and institutionalised" (Finger and Brand, 1999, p. 147). Fourth, there is a need to develop measurements of an organisation’s
“capacity to learn”. On this basis, Finger and Brand propose a conceptualisation of organisational learning capacity and link it to existing theories of organisational learning and the learning organisation (Finger and Brand, 1999, 147 - 151).

3.2.3 Management’s Effect on Organisational Learning

Carmona and Grönlund (1998, pp. 21 - 38) conducted two long-term empirical studies of subsidiaries of European car manufacturers based in Sweden and Spain, with the intention of demonstrating how the process of organisational learning may be hindered by an accompanying process of organisational forgetting. Both organisations operate in a highly competitive market utilising contemporary technology. The projects were designed to foster operational learning through team work in problem-solving and innovation support. The expected outcomes were to achieve improvements in productivity, quality and working conditions. A structural perspective was adopted as some elements of structure, including the budgeting system, may take an important role in storage and retrieval of organisational memory. Data sources included minutes of team meetings, interviews of participants and workshops with middle managers (Carmona and Grönlund, 1998, pp. 21 - 24). The Spanish teams, that operated informally, consisted of middle managers and all the operators working in designated areas. The Swedish teams, who were recognised in the organisational structure, included a supervisor, a
foreman and a number of operators (Carmona and Grönlund, 1998, pp. 25 - 26). It was found that the Swedish project showed a long period of organisational learning with a large number of small improvements, a successful outcome. A similar result was obtained in the Spanish project, however a notable process of “organisational forgetting” ensued (Carmona and Grönlund, 1998, pp. 29 - 30). The different outcome in the Spanish project was traceable to a number of factors. Initially organisational learning (in terms of improved output by reducing machine setup time, for example) was apparent as teams resolved problems that were in their control. However, once problem-solving extended beyond their boundaries there were no formal structures of communication or recognition of the teams to allow interaction with other parts of the organisation, and no effort was made by the management to address the situation. Consequently, new routines that had been learnt by the teams through their own commitment were ceased, an example of organisational forgetting (Carmona and Grönlund, 1998, pp. 29 - 30). The budgeting system in the Spanish project also stymied team development as teams had no budget allocation to support their actions and the improvements achieved did not result in changes to resources to the teams (Carmona and Grönlund, 1998, pp. 31 - 32). There is a macro level of analysis in comparing the Spanish and Swedish projects according to Carmona and Grönlund. The Swedish organisational functioning is decentralised, however, there are basic principles that are centralised. In contrast, the Spanish organisational structure inhibited middle managers from conveying an answer
to the difficulty encountered to top management – “they considered that their requests would interfere with top management’s understanding of the situation. They kept silent” (Carmona and Grönlund, 1998, p. 35).

3.2.4 A Knowledge-Creating Structure

In an empirical study of aircraft manufacturing, Ayas (1999, pp. 176 - 193) argues that innovation is a learning process as it has the capacity to highlight the need for change, and consequently the need for learning and adaptation to use the innovation (Ayas, 1999, p. 177). Organisational learning in the study is regarded as a process involving individual learning and consensual interpretations of knowledge, from which organised action can result (Ayas, 1999, p. 180). Ayas argues “…that the nature of learning and its contribution to product innovation is influenced by the organisation’s structure, the communicative practices and the social context…” and that these factors are influential in producing behaviours attributable to organisations in contrast to individual behaviour (Ayas, 1999, p. 181).

Following the analysis of multiple case studies with an aircraft manufacturing plant, a range of problems were identified and a “knowledge-creating structure” was determined as the most appropriate response. This involved the creation of autonomous, self-managed work teams with specific tasks that had direct linkages to a cross-functional core team, thereby producing a network
capable of expanding the organisational knowledge base (Ayas, 1999, pp.186 - 187). The new way of operating was found to lead to improvement when a comparison was made between similar project outcomes before and after implementation, indicated by a reduction in budget over-runs and time over-runs (Ayas, 1999, p. 187). Ayas does not only attribute the improvements to structural change because there were extensive training sessions provided to participants over a considerable period of time (Ayas, 1999, p. 188). Consequently, both in the training sessions and in the performance of work related tasks, there existed significant opportunities for learning through direct personal contacts and through direct experience (Ayas, 1999, p. 189). “The results suggest that a project organisation constituted through project network structures has a positive influence on project success” (Ayas, 1999, p. 191).

3.2.5 Learning by Doing

An empirical investigation of the merger of two organisations was conducted by Leroy and Ramanantsoa (1997, pp. 871 - 895). They define organisational learning as:

...the collective phenomenon of the acquisition and development of cognitive and behavioural skills, knowledge and know-how, resulting in a more or less profound and durable modification of
the way organisations are managed. (Leroy and Ramanantsoa, 1997, p. 871).

Leroy and Ramanantsoa argue that current studies of organisational inappropriately favour a cognitive model of learning (the emphasis is on changes in mental states) and that there is a need to integrate cognitive and behavioural models of learning because they so closely interact (Leroy and Ramanantsoa, 1997, pp. 874 - 875). To that end, they adopt a framework proposed by Inkpen and Crossan (1995) that integrates cognitive and behavioural aspects of learning together with analysing interactions between the two models. Leroy and Ramanantsoa argue that the integrative model of learning they propose applies to any learning entity whether it be an individual, group, or organisation and attempts to assimilate within it the concept of tacit and explicit knowledge conversion (Leroy and Ramanantsoa, 1997, pp. 887 - 879). They explain that adeptness at learning in their integrated model of learning “necessitates an adjustment between different phases of cognitive and behavioural change” (Leroy and Ramanantsoa, 1997, p. 875). Hence, learning may be blocked in situations where learning is forced, such as when changes in behaviour are required without knowing the reasons why. Alternatively, learning may be enhanced by experimental learning, where changes in knowledge and behaviour are gradual and result from learning by trial and error (Leroy and Ramanantsoa, 1997, pp. 876 - 877).
The integrative model of learning was applied to the merger of two biscuit manufacturing organisations that had different motivations to merge. One had limited resources in a threatening environment; the other had declining profitability and slowed innovation (Leroy and Ramanantsoa, 1997, pp. 881 - 882). The empirical study was conducted over eight months with the researchers’ taking a “participant-as-observer” role. A large range of data sources was utilised in an iterative, interactive, cumulative manner and included documents, interviews, observation and meetings, together with archival data, that were analysed in relation to integrative learning model. Those responsible for the merger used a relatively large number of “merger workshops” for selected employees to compare systems and skills; however, initially they were observed to take a role in reducing resistance rather than facilitate learning. Over time, learning from different viewpoints developed into consensual decision making, including the determination of training needs to aid implementation (Leroy and Ramanantsoa, 1997, pp. 882 - 889).

Leroy and Ramanantsoa concluded that the learning they observed “was the result of practice, repetition, experimentation and socialisation in communities of practice” (Leroy and Ramanantsoa, 1997, p. 887) that was more than applying cognitive learning that occurred in the merger workshops. The emphasis was on “learning by doing” while not overlooking the need for formalised learning in the initial stages. (Leroy and Ramanantsoa, 1997, pp. 887 - 889). While there were a range of difficulties observed in the merger
process, such as the limitation on the number of employees who could be
directly involved in the merger workshops, the main conclusion reached by
Leroy and Ramanantsoa was “that cognitive learning must be completed and
revised by a behavioural phase of experiential learning” (Leroy and
Ramanantsoa, 1997, p. 890). They further observe the need for ways of
“conceptually capturing organisational learning” and ways of explaining the
processes of learning that occur in organisations (Leroy and Ramanantsoa,

3.2.6 Organisational Learning Due to a Crisis

Hutchins (1995, pp. 1 - 48 and pp. 317 - 351) observed directly how the staff
on the bridge of the ship responded to the situation of the ship’s propulsion
system failing as it was heading for a pier. There was consequentially a loss of
power and a main gyrocompass ceased to function that left the navigation
team without a crucial piece of navigation equipment. Navigation without the
gyroscopes is a complex computational task (Hutchins, 1995, pp.317 - 320) but
the situation required the bridge team to bring the ship to anchor in a location
that would not obstruct other sea vessels nor cause damage to the ship itself.
The situation of the navigation crew was not covered in operations manuals or
training, hence the crew had no source of direction for dividing the manual
computational task between them that would allow the ship to be anchored
safely (Hutchins, 1995, pp. 320 - 321). Initially, the manual computation was
taken-up by the quartermaster chief, and then an organised social structure with division of labour emerged implicitly out of the chaos. As a result of the emergent social structure the ship was navigated successfully to the preferred anchorage (Hutchins, 1995, pp. 322 - 342).

In analysing the adaptation the navigation team made in a crisis situation with no precedent for action, Hutchins argues that it demonstrates:

...an organisational change that is produced in part by an evolutionary process (adaptive search without representation of the search space) and in part by a process that lies between evolution and classical global perspective design.


According to Hutchins, the navigation team reorganised as a consequence of the team members changing their perspective of rules, roles and routines; the organisational design or structure was changed. However, none of the team could claim to have known the solution to the crisis individually, so the organisation of the team was simultaneously a product of evolution (Hutchins, 1995, pp. 350 - 351). Therefore, Hutchins argues that: “The processes by which work is accomplished, by which people are transformed from novices into experts, and by which work practices evolve are all the same processes” (Hutchins, 1995, pp. 351). A similar anthropological empirical investigation
was undertaken by Hutchins and Klausen (1998). They found that the
distribution of cognition was also evident in the functioning of the staff of an
airline cockpit (Hutchins and Klausen, 1998).

3.2.7 Organisational Learning at the Subculture Level

Huzzard (2000) suggests that the mainstream literature on organisational
learning “is overwhelmingly managerial in its approach, seeing learning as a
tool for the assertion of control and improved organisational effectiveness
from a top-down perspective” (Huzzard, 2000, p. 354). He argues that there is
value in adopting an organisational learning perspective at the level of
workplace collectivities. According to Huzzard, it is inappropriate to equate
learning simply with behaviour change and/or information processing. Rather,
he argues that organisational learning is “a retrospective sense-making process
whereby actors...do not simply respond to environmental stimuli, they also
impose a construction of reality on their environment and act accordingly”
(Huzzard, 2000, p. 359). As a result, Huzzard emphasises the meaning that
people place on their work experiences as a crucial factor in organisational
learning. Subsequently Huzzard investigates learning in relation to labour
process changes in a large supplier organisation linked to the
telecommunications industry. He interviewed union club leaders over a period
of four days in late 1997 during which a program of 10,000 redundancies was
announced by corporate management. The interviews were supplemented by
informal discussions with rank-and-file union members together with secondary sources of materials such as the organisation’s annual report, newspaper reports and journals Huzzard, 2000, pp. 359 - 362).

From the union perspective, Huzzard considers the unfolding of significant management organisational changes over a seven year period. This included the introduction of new work practices supported by the worker’s union, such as a “customer-focused strategy” that encompassed team working, implemented in the early 1990’s, to the union opposed corporate strategy to outsource and downsize. In his analysis, Huzzard identified two distinct learning cycles in the workplace collectivities. The first learning cycle encompassed a negotiated social partnership that was infused with the company’s desire to bring about changes to the labour process, such that learning went beyond the technical production processes. The second learning cycle evolved through a:

Lack of comprehension about management’s motives...[that] rapidly spread to a general sense of mistrust and the mounting of a campaign of sustained opposition both inside and outside the plant. Learning here concerned campaigning techniques, the need for close inter-union co-operation as well as networking with other union clubs both inside and outside the [company].

(Huzzard, 2000, p. 370).
Huzzard argues that his empirical study "suggests that both the outcomes of the learning processes and the extent to which actors are able to put new knowledge into use are related to considerations of intra- and inter-organisational power" (Huzzard, 2000. p. 370), an area he notes as requiring investigation in the field of organisational learning (Huzzard, 2000, pp. 370 - 371).

3.2.8 The Role of Conversation

King and Rowe (1999, pp. 431 - 448) initially conducted empirical research in a large telecommunications firm and concluded that there was little appreciation of the processes taking place in the almost exclusive team-based organisational structure. For example, they observed that many ideas brought forward in meetings were discounted for the sake of addressing systematic organisational output timelines and simplified in meeting minutes as to almost be useless or meaningless. According to King and Rowe, existing academic theorising has tended to emphasise a linear description of what happens in collectives at the expense of socially constructed phenomena and the constructed nature of reality. They argue that the generative capabilities of collectives could be better harnessed if they were permitted to employ a more heterogeneous method of chronicling collective processes. In this regard, King and Rowe investigated an inter-departmental project team that was trying to move the focus of the parent company to a multi-media approach to
telecommunications. They noted and diagrammatically represented the discussion points raised by individual collective members and their relational aspects, which subsequently demonstrated the non-linearity of the process leading to the eventual outcome (King and Rowe, 1999, pp. 440 - 442).

King and Rowe acknowledge that the re-presentations of conversations diagrammatically are abstractions, however, they are also “examples of the layers of multifarious processes continually at work as a collective is making sense of its reality (King and Rowe, 1999, p. 439). They extend their argument of re-presenting collective learning by including external linkages in the record of conversations. It is suggested that people analysing the conversation diagrams are more likely to appreciate an organisation’s knowing and that:

…it is considerably easier for organisations to identify, capture and utilise a collective’s knowing than with individuals working alone, whose knowing can remain tacit, unexplicated and often beyond the reach of the wider organisation.

(King and Rowe, 1999, p. 446).

According to King and Rowe the continuing development of hypertext technology systems represents an enormous potential for managing
organisational learning for this would allow access to documents at any point 
(King and Rowe, 1999, p. 446).

3.2.9 Tacit Learning and Tacit Practices

Heath and Luff (1998) studied line control and passenger information on the 
London Underground (Heath and Luff, 1998, pp. 96 - 129). They aligned “the 
focus towards the sociointeractional foundations of task-based activities” in “a 
relatively circumscribed division of labor” (Heath and Luff, 1998, p. 97) 
They found that controller trainees were apprenticed to particular personnel 
and attempted to learn through observation and instruction during actual 
problems of providing the service, rather than formal instruction (Heath and 
Assistants, and Signalmen is not simply learning to undertake a body of 
relatively complex and specialised tasks, but rather learning to accomplish 
those activities with respect to real-time contributions and demands of 
personnel both within and outside the Line Control Room (Heath and Luff, 
1998, p. 119). Consequently, the learning involves accomplishing individual 
tasks and activities that are intertwined with consistent interaction with 
colleagues. Heath and Luff note that the complexity of the practices in the 
Control Room is taken for granted and are not articulated in a formal sense. 
They found that successful completion of relatively routine tasks could only
be achieved through direct interaction with others and by adhering to tacit practices. In addition, it was found that tasks undertaken by staff are simultaneously attuned to the emerging tasks of their colleagues to avoid any unnecessary disruption, which conveys a notion of fluidity about how the collectivity operates (Heath and Luff, 1998, pp. 119 - 121).

In the light of these practices, Control Room Personnel are continually and unavoidably, implicitly and explicitly, gathering and distributing information to each other concerning the “current” operation of the service. (Heath and Luff, 1998, p. 122). Heath and Luff demonstrate how the “fluid” and expert practices in the Control Room are supported by the use of mutually available diagrams, representations and other technology that aid mutual monitoring and coparticipation, and thereby make provision for effective collaborative action (Heath and Luff, 1998, pp. 121 - 126). They argue that the use of various tools and technologies renders the actions of individuals visible, and those actions may intrinsically inform colleagues.

Consequently, Heath and Luff question the wisdom of delineating individual cognitive capabilities from the collaborative and also the usefulness of approaches that place individuals at the forefront of the analytical domain (Heath and Luff, 1998, p. 125). They suggest that their observations set a direction “...in which a concern with the interactional organisation of work
and occupations may lead to a respecification of the organisational conduct …” (Heath and Luff, 1998, pp. 127 - 128).

3.2.10 Tacit Knowledge and Intuition

Bennett and Anthony (2001, pp. 185 - 209) investigated the importance of using tacit knowledge and intuitive scrutiny, together with traditional explicit knowledge and factual analysis in the decision making of bank boards. The intention was to contribute to the limited knowledge concerning an organisation’s effectiveness in relation to the information and knowledge board members is part of the cause (Bennett and Anthony, 2001, p. 186). Self-report survey responses from 359 bank board members from a range of independent banks were analysed (Bennett and Anthony, 2001, p. 190). The survey asked a range of questions that asked board members to reflect on their cognition and behaviour with respect to the strategic deliberations in which they were involved such as objective bank performance, perceived board performance, board activity level, insider analysis and outsider analysis (Bennett and Anthony, 2001, p.p. 191 - 194).

The statistical analysis of the results indicated that all board members, whether from inside or outside of the organisation, used “fairly high levels of analysis and intuition in the board deliberations and discussion” (Bennett and Anthony, 2001, p. 194). It was found that the tacit-intuitive contributions were
more likely to come from board members who came from outside of an organisation (Bennett and Anthony, 2001, p. 197). Conversely, board members who came from inside of an organisation were more inclined to adopt explicit-analytical tendencies (Bennett and Anthony, 2001, p. 194). Further analysis revealed that a combination of tacit-intuitive input, and explicit-analytical input improved the board deliberations and overall performance (Bennett and Anthony, 2001, pp. 205 - 206).

Bennett and Anthony conclude that “strategy research can benefit greatly from systematic application of scientific knowledge on attitudes, information processing, decision making, motivation, communication, and other softer cognitive subjects. The more researchers know about humans within management systems, the more explanation and predictive power can be provided (Bennett and Anthony, 2001, p. 207).

3.2.11 Organisations Learning from Each Other

Dixon (1999, 115 - 129) facilitated an action research study of the staff of six Canadian museums with the aim of determining whether they could learn from each other. The problem faced by all the museums was a need to respond to their changing socio-economic environment. Six principles of collective learning were adopted: teams/organisations as the unit of learning, organisational assumptions are limiting, co-inquiry, collective intelligence,
learning occurs over time, collaboration and alliances Dixon, 1999, p. 115). The learning strategy involved representatives from each museum being involved in a three day “learning forum”, held after a “planning forum”, and followed by a “reflection forum” (Dixon, 1999, pp. 116 - 127).

It was found that individual teams, consisting of members from the one institution, were able to “reinvent themselves” and adapted to the new socio-economic situation based on the collective new knowledge gained at the learning forum. However, the collaboration between the teams dissipated quickly after the learning forum. Dixon observed that this may have been due to the relatively short time of three days that the groups had worked together. It was also noted that trying to convey “learning across organisations” as an abstract concept was not suitable for group work. Dixon concludes that learning about “learning from others” was more effective where it was directly linked to an outcome perceived as tangible and useful (Dixon, 1999, p. 128).

3.2.12 Organisational Learning as Change

In the period 1992 to 1995, Enderby et al (1998, pp. 129 - 145) undertook an extended case study of large scale organisational change at a private hospital, which involved the redesign of the management structure and the physical layout of the organisational operations. The change agenda also included the
need to “increase the knowledge and skill capital within the hospital through the generation of organisational learning” (Enderby et al., 1998, p. 131). The hospital adopted an overarching concept of care that focused all activities on how the patient would experience them. As an outcome of the study, Enderby et al. defined a learning organisation as:

...one which continuously monitors its performance and health, reflects on that data and then modifies its behaviour in the light of the knowledge gained, so as to ensure its long term survival and growth. A learning organisation is one that is continuously improving.

(Enderby et al., 1998, p. 135).

At the crux of the analysis of organisational change conducted by Enderby et al. was the analysis of actions deemed to have most influenced the change process and outcomes. The data were collected through participant observer case narratives, secondary analysis of survey data (patient satisfaction surveys) and tape recorded interviews with hospital managers (Enderby et al., 1998, pp. 132 - 133). Analysis of the data demonstrated that there was wide variation in the understanding of what organisational learning is. Understandings ranged from remembering what has happened in the past to physically changing things to incorporate what has been learned (Enderby et al., 1998, pp. 135 - 137).
Enderby et al subsequently argue that there are two dimensions that are critical in organisational learning. The first perspective sees organisational learning as basically the education and training of individuals and groups (collectives) that improves the knowledge and skill capital of an organisation. In contrast, the second perspective views organisational learning in an interventionist, structural-cultural way in which the knowledge and skill capital of an organisation is increased and retained. Examples of the second perspective include the construction of purpose built buildings, flattening of the organisational structure and the formation of self-directed working teams (Enderby et al, 1998, pp. 137 - 139). With this in mind, Enderby et al conclude that:

Change managers should employ a wide repertoire of interventions in pursuit of organisational learning. Among these the introduction of action learning teams is likely to result in positive learning outcomes.(Enderby et al, 1998, p. 144).

3.3 General Themes and Constraints

Table 2. (page 105) summarises the variety of the contributions from the empirical investigations into organisational learning. There is a tendency for most authors to assume how learning occurs and there is often an overarching emphasis on improvement of performance (behaviour change) as the main
measure of learning, however, change in behaviour may simply indicate conformity due to other pressures. Except for Hutchins (1996), Heath and Luff (1998), Huzzard (2000) and Hutchins and Klausen (1998), there is a tendency to view organisational learning as radical change. There is also an emphasis on planned learning as a top-down management tool for "structuration" or "institutionalisation". Generally, the learning that may take place irrespective of managerial interventions and observable changes is overlooked. The same contentious issues attributed to theoretical accounts of organisational learning in Chapter Two equally apply to the investigations summarised in this Chapter. There is no agreement on what learning is. Further, there seems to be no agreed position on specific methods and techniques that may be used to investigate organisational learning.

3.4 Summary

This Chapter has shown that there is no agreement on what learning is, nor what constitutes organisational learning. The Chapter also shows that there is wide variation in methodologies used to investigate organisational learning. Thus, the same issues identified in Chapter One equally apply to empirical investigations of organisational learning.

It seems clear that organisational learning cannot be understood without a strong, supportable conception of learning itself. Chapter Four initially
considers what is the appropriate form of enquiry to determine the best model for human learning. This is followed by a detailed account of what cognitive science has to offer in promoting an understanding of learning.
Table 2. Empirical Investigations of Organisational Learning at a Glance

<table>
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<th>Study</th>
<th>Description</th>
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<td>Antanacopoulo (1999)</td>
<td>Longitudinal case study of retail bank managers to ascertain what characterised and determined the negative or positive attitudes of managers towards learning.</td>
</tr>
<tr>
<td>Finger and Brand (1999)</td>
<td>In-depth case study of the transformation of a public sector organisation to a “learning organisation” using principles of individual experiential learning and collective learning.</td>
</tr>
<tr>
<td>Ayas (1999)</td>
<td>The development of a knowledge creating organisational structure through the establishment of self-managed work teams with direct linkages to a cross-functional core team.</td>
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<tr>
<td>Leroy and Ramanantsoa (1997)</td>
<td>The integration of cognitive and behavioural models of learning applied to the merger of two manufacturing organisations.</td>
</tr>
<tr>
<td>Huzzard (2000)</td>
<td>Investigation of the learning that occurs in organisational subcultures during major management led organisational changes.</td>
</tr>
<tr>
<td>King and Rowe (1999)</td>
<td>Analyses the importance of conversation in organisational learning and proposes a methodology to record the intricate processes for later use.</td>
</tr>
<tr>
<td>Bennett and Anthony (2001)</td>
<td>Analysis of the cognitive processes used by corporate board members, including the combination of explicit and tacit inputs to their deliberations.</td>
</tr>
<tr>
<td>Dixon (1999)</td>
<td>Action research study to determine if organisations can learn from each other using principles of collective learning.</td>
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Chapter 4:

Approaching Learning Scientifically and the Reasons Why

4.1 Introduction

The diversity in learning theories is testament to the complexity in understanding the process of learning. In a recent book, Mower and Klein (2001, pp. 1 - 21) describe the transitive nature of contemporary learning theory that is demonstrated by the move from all-encompassing theories to more specific theories. Most notably, they argue that the process of learning is underpinned by biological factors that tend to negate the idea of general laws of learning (Mower and Klein, 2001, p. 18). It is apparent from the contemporary learning theories compiled by Mower and Klein, as just one set of examples, that there is no universally accepted theory. As is evident from the theoretical survey of organisational learning literature in Chapter Two and the empirical investigations of organisational learning in Chapter Three, the field is readily influenced by the various theories of individual learning. A difficulty arises when more than one concept of learning is assumed without a clear explanation as to why a particular learning theory is the most appropriate.

The following section will consider the complex philosophical context in which this thesis is grounded. This is necessary because this thesis has
adopted Kaplan's (1994) research methodology for the behavioural sciences, as described in Chapter One, which allows for the integration of methodology, technics and philosophy. The intention is to outline briefly the philosophical discussion so that this Chapter, and those that follow, may be viewed with some common understanding of central material to this thesis. The remainder of the Chapter reviews traditions of learning theory, including behaviourism and cognitivism, and models of learning that have been developed in cognitive science. In particular, artificial intelligence and connectionism are the models of learning considered in detail. The overall aim of this Chapter is to seek the best, empirically sound, model of individual learning.

4.2 The Relevance of Scientific Enquiry

Churchland (1986) argues that research based on a scientific approach compels the contemplation of the coherence and coincidence of enquiries within a broad framework (Churchland, P. S., 1986, p. 239). Churchland is not referring to the type of science espoused by positivist empiricism, such as behaviourism, that accepts a sharp separation between matters of fact (the observed empirical understanding of the world) and relations between ideas (reasoning as it applies to logic and mathematics) as underpinning their theory of knowledge (Churchland, P. S., 1986, pp. 242 - 258). This is a limited view according to Churchland, for what is observed is dependent on prior knowledge through which the world is seen and the kinds of instruments of
observation that are used. Put another way, there is always some form of theoretical construct (mental models and attributions) through which an individual’s observations are interpreted. In Churchland’s view, positivist empiricists run into difficulty because they preclude interpretation as having a place in the theory of knowledge, and yet all observations are interpreted (Churchland, P. S. 1986, pp. 259 - 271). In contrast to the science of the positivist empiricists, Churchland (1996) is referring to Quine (1969) and the postpositivist science he proposes (Churchland, P. S., 1986, p. 266 - 267).

Quine (1969) argued that knowledge should not be justified or reduced to either the immediate sensory experiences of human beings or the simple application of logical principles. He was writing at a time when cognitive psychology was gaining prominence. Accordingly, rather than overlooking the mechanisms of mind and the reduction of learning and beliefs to observable changes as positivist empiricists do, Quine (1969) proposed, from a naturalistic philosophical perspective, that empirical psychology should take the place of the positivist empiricist tradition (Quine, 1969, pp. 419 - 428).

Building on Quine’s work, Churchland (1986) argues that the principles for rational conduct in scientific enquiry lie in determining how the brain accomplishes its cognitive processes which would then allow the development

In this regard, it is appropriate to recognise that all knowledge accumulation or learning involves some interaction and change to the human organism’s biochemical and electrochemical systems, including the brain. Hence, each individual constructs and changes their own view of the world through learning, which results from their perceptive and sensory activity, which is converted to biological processes². Individuals systematically establish their own theories that attempt to bring order to the natural and social phenomena they experience. This being the case it is necessary to explore how individuals may contribute to scientific enquiry. In this regard, Phillips and Burbules (2000) provide a philosophical argument appropriate to this thesis by considering scientific rationality as it may apply to the social sciences.

Phillips and Burbules (2000) have defended postpositivism in educational research. They helpfully clarify that postpositivism:

² An introduction to the notion that consciousness results from chemical systems operating in the human body is provided by Hobson (1994). A more detailed neuroscience overview of the brain’s functioning can be found in Churchland and Sejnowski (1992, pp. 17 - 60).
...is not a form of foundationalism, and so it is not a form of rationalism or empiricism (and thus is not a form of positivism). Postpositivism is a nonfoundationalist approach to human knowledge that rejects that knowledge is erected on absolutely secure foundations – for there are no such things: postpositivists accept fallibilism as an unavoidable fact of life...the postpositivist sees knowledge as conjectural. These conjectures are supported by the strongest (if possibly imperfect) warrants we can muster at the time and are always subject to reconsideration. (Phillips and Burbules. 2000, p. 29)

Phillips and Burbules argue that postpositivists do not necessarily all think in the same way (Phillips and Burbules. 2000, p. 30). Rather, it is recognised that every enquirer has to adopt a construction and that they may interpret it in a different way to someone else. Nevertheless, Phillips and Burbules note that “relativity of perspective does not necessarily lead to subjectivity, and relativity does not always warrant the charge of being biased”. They further recognise that obvious distortions of perspective must be regarded as biased (Phillips and Burbules, 2000, pp. 46 - 47). According to Phillips and Burbules, the strength of scientific inquiry rests in its tradition of striving for objectivity and its openness to criticism for example (Phillips and Burbules, 2000, p. 60). They argue the traditions of scientific enquiry can be equally applied to competent research in the social and natural sciences, and
educational research (Phillips and Burbules, 2000, p. 67). While they recognise that there are opponents to the postpositivist approach to research in the social sciences, this may be due to misunderstandings of the nature of science attributable to the negative connotations prompted by the positivist school of thought (Phillips and Burbules, 2000, pp. 66 - 67).

Phillips and Burbules analyse postpositivism's applicability to sociocultural inquiry. They do so by considering explanations of human action and human behaviour, the act of interpreting human action and interpreting texts, and causation in the social world. They reveal a significant difference between 

*behaviour* and *action*. Whereas a theory or law of nature may explain behaviours, actions have reasons, motives, purposes, values or ideas behind them. Phillips and Burbules observe that human beings may demonstrate behaviour such raising an arm, however, in so doing they may also be exhibiting an action if by raising an arm they are voting for a particular outcome, for example. The raising of an arm to vote has a causal\(^3\) aspect to it.

Perhaps the desire for a particular outcome has prompted the action in respect

\(^3\) Causation is a highly complex philosophical field. For example, Westphal (1969) concludes that it is wrong to ask if actions are caused or uncaused because human actions are not comparable to the laws of physics or mathematics (Westphal, 1969, p. 155 – 156). According to Westphal (1969), the important need is to distinguish between *reasons* and *causes* (Westphal, 1969, p. 160).

As a further demonstration of the complexity of arguments concerning causation, Jacob (1997) develops a causal explanation of behaviour by considering intentional behaviour, and distinguishing causal explanations from causation and non-causal explanations (Jacob, 1997, pp. 141 – 269) after describing his approach to a naturalistic account of intentionality that unifies mental states, properties of the environment, phylogenetic evolution and ontogenetic development (Jacob, 1997, pp. 9 – 204).
to the meaning that has been attached to it. Phillips and Burbules note that further inquiry may reveal that raising an arm was simply a matter of compliance or a health related affliction rather than an individual motive (Phillips and Burbules, 2000, pp. 68 - 72).

Phillips and Burbules suggest that opponents of a natural science approach to sociocultural enquiry may argue that because understanding a human action requires interpretation or hermeneutics this demonstrates its unsuitability for sociocultural oriented inquiry. However, the authors conclude that providing an enquirer has competently collected evidence to lend support to an interpretation:

There is nothing unscientific about an educational researcher studying human actions (not merely behaviours) and seeking to understand the reasons, beliefs, motives, purposes, and so forth, that lead individuals to act the way they do in educational and other social settings. Of course, these things can be studied in an unscientific way – when appropriate evidence is not collected, when disconfirming evidence is not sought, when hypotheses favoured by the researcher are advanced without competent probing and evaluation, and when threats to the study are ignored or not counted. We researchers are human beings, and the beliefs we form are liable to be erroneous. The scientific spirit – the
postpositivist scientific spirit – is that, no matter what our inquiries are about, we should do as much as humanly possible to ensure our beliefs are well-founded...


Causation in social settings, such as organisations, is specifically considered by Phillips and Burbules. They argue that the methods of scientific inquiry are applicable in considering individual human action and also macrolevels in society. For the purposes of this thesis, macrolevels would include organisations. What is critical, they contend, is that where it is believed that causal chains of events are operating due to socio-cultural values, meanings or natural laws, for example, that there is also solid evidence in support of the belief. In their view the greatest difficulty is how causal mechanisms can be revealed and then put to good use (Phillips and Burbules. 2000, pp. 89 - 92).

In the postpositivist vein described by Phillips and Burbules (2000), the best empirically supported explanation of individual learning and the best available model of individual learning will be sought in the following sections.
4.3 The Demise of Behaviourism and the Rise of Cognitivism

As noted in Chapter Two, behaviourism is a theoretical viewpoint that emphasises the study of overt behaviours that can be directly observed and measured. It is based on the premise that everything concerning learning has to be defined in terms of behaviour because science could not study the "invisible learning machinery" that is in a person’s head. In effect, behaviourists ignored the possibility of thought processes taking place in the mind. Some of the key contributors to the scientific development of behaviourist theory were Pavlov, Watson, Guthrie, Thorndike, Hull and Skinner. Accordingly, their work largely centred on investigation and experimentation of stimuli (conditions that lead to behaviour), responses (actual behaviour) and rewards (Lefrançois, 2000, p. 21). A brief overview of the contributions to behaviouristic theory will provide the basis for a general critique.

Stimulus-response reactions and conditioning are most readily aligned with the investigations conducted by Pavlov (1849 - 1936) into the reactions of dogs to the ringing of a bell with the sound being associated with food (Lefrançois, 2000, pp. 27 - 39; Leahey and Harris, 1997, pp. 18 - 34). Watson (1878 - 1958) built on the work of Pavlov from a psychological perspective. His research demonstrated the role of conditioning in the development of emotional responses to certain stimuli. Watson’s experiment involved the production of a frightening loud noise as an infant petted a white rat. Initially
unafraid of the rat, the infant began to associate the loud noise with the rat and subsequently became afraid of the rat and other small animals\(^4\). Watson developed his theory to include an explanation of higher learning that he postulated resulted from “the conditioning of more stimulus-response reactions, eventually leading to what he called habits” (Lefrançois, 2000, pp. 39 - 48). The behaviouristic orientation of Guthrie (1886 - 1959) differed to Pavlov and Watson. Put simply, Guthrie’s view of learning was that whatever response to a stimuli occurred, it would be repeated at the same strength as initially experienced in the event of the same stimuli. Subsequently this became known as one-shot learning (Lefrançois, 2000, pp. 48 - 57; Leahey and Harris, 1997, pp. 46 - 52).

Thorndike (1874 - 1949) and Hull (1884 - 1952) differed markedly from the previous researchers. Thorndike theorised that learning resulted from the formation of a connection between stimulus and response and emphasised the consequences of behaviour (reward and punishment). He formulated “laws” of “effect”, “exercise” (repetition), and “readiness” to explain learning (Lefrançois, 2000, pp. 63 - 75; Leahey and Harris, 1997, pp. 35 - 39). In a somewhat similar vein, Hull developed mathematical formulae to describe the links between input (complex stimulus) and output (response) variables with a view to predicting behaviour (Lefrançois, 2000, pp. 75 - 87; Leahey and Harris, 1997, pp. 52 - 55).

\(^4\) In fact, there are varying accounts of the experiment and the methodology and conclusions drawn have been subsequently criticised (Lefrançois, 2000, p. 45).
Skinner's (1904 - 1990) theory differed so much from all of the preceding behaviouristic accounts of learning, that it became known as radical behaviourism. Skinner elaborated on previous explanations, however, he still relied on directly observable phenomena. His main departure from other behaviourist theories resulted from his studies of voluntary behaviours in response to the environment, called operant conditioning. The classical illustration of operant conditioning is the experimental chamber that demonstrates animals pulling a lever in response to a light and obtaining food (Lefrançois, 2000, pp. 90 - 133; Leahey and Harris, 1997, pp. 72 - 88).

According to Green et al (1996), there are two main problems associated with the behaviourist account of learning: i. learning may occur without any accompanying change in behaviour, such as when subjects under the influence of muscular paralytic drugs are subjected to conditioned or unconditioned stimulus such as electric shock, a corresponding conditioned response may occur when the effects of the drug wear off. ii. organisms acquire more than new types of behaviour, demonstrated when rats used to negotiating a maze to obtain food will still take the right route if the maze is filled with water and swimming is required. Green et al argue that learning in the second case demonstrates the involvement of the acquisition of knowledge of the spatial layout of the maze which is more than acquiring muscle activity conditioned to a stimulus (Green et al, 1997, p. 281).
Despite the useful contributions of behaviourist investigations, it could be argued generally that the behaviourist learning theories rely on research that studies relatively simple forms of learning and then extrapolates the outcomes to fit accounts of human behaviour. For example, behaviourism significantly influenced administrative theories during the 1950’s and 1960’s. Such theories were considered coherent if they could be directly linked to behaviourist accounts of sensory experiences. As might be expected, the mind was considered irrelevant in the majority of administrative theories developed at the time. For example, researchers in educational administration claimed that to understand administrative decision-making behaviour of an individual under certain conditions it was only necessary to observe the relevant causes bearing on the individual at the time – a case of observable “outputs” attributable to observable “inputs” with no mental processing of the inputs occurring (Evers and Lakomski, 2000, pp. 8 - 9). According to Evers and Lakomski (2000), there are five fundamental difficulties in adopting a behaviourist account of complex administrative processes:

i. …[there is a difficulty in identifying] precisely which input stimuli in a given situation are regularly associated with particular cognitively oriented output behaviours.

ii. …the fact of creativity compromises the business of finding correlations.
iii. ...there is an arbitrarily large number of ways in which environmental can be classified into relevant inputs. However, to make it all work in a plausible way, a background heuristic a seems to be tacitly employed that selects inputs into those that might be attended to, or those of interest, or those being thought about – a heuristic, in other words, that appeals to “inner states”.

iv. ...the basic criteria for appraising decision-making strategies, have a global quality...

v. ...the evaluation of decision-making and other cognitive behaviours is characteristically done on representations of these phenomena – invariably symbolic representations – which are assumed to be in some sense in the mind guiding administrative behaviour.

(Evers and Lakomski, 2000, p. 10. italics in original source).

It is not surprising, given the points raised by Green (1996) and Evers and Lakomski (2000) that a new way was sought to explain behaviour and learning.

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5 A heuristic is a strategy or procedure for solving a problem which has high utility (it may be quick and economical) but it is not foolproof; a trial and error approach (Green et al, 1996, p. 374)
The scientific investigations cited above by Green et al (1996) to repudiate the behaviourist account of learning reflect the work of Hebb (1904 - 1985) and Tolman (1886 - 1959) who conducted a range of experiments with small animals. Hebb speculated that there were mental processes taking place between a stimulus and response and those could be understood and described in terms of neurological activity. Tolman expanded on this by speculating that all behaviour is purposeful and involves cognitive elements such as expectation (LeFrançios, 2000, pp. 155 - 176). Closely aligned with Hebb’s and Tolman’s challenge to the mechanistic approach to learning of the behaviourists was the development of gestalt psychology. An expression commonly associated with the gestaltists is “The whole is greater than the sum of the parts” that demonstrates the move from the emphasis on component parts to a whole. The insistence on objectivity, as demonstrated in behaviourism, was relaxed in gestalt psychology and thereby assisted a move of theorising into the realm of higher mental processes such as perception, awareness, problem solving and insights. The works of Koffa (1886), Köhler (1887 - 1967) and Wertheimer (1880 - 1943) demonstrate theorising in the gestaltist tradition (LeFrançios, 2000, pp. 176 - 189). Thus, the grounding for what was to become modern cognitivism was established.

Cognitivism recognises that mental processes form an integral part of behaviour and learning, as noted in Chapter 2. Two of the major players in the development of cognitivism are Bruner (1915) and Piaget (1896 - 1980). Both
researchers based their theories on human rather than animal research and assumed some form of mental representation. Some key aspects of the cognitive theory of Bruner include: perception, memory, thinking, problem solving, cognitive structure, abstraction, symbolic representations (language), attributes (qualities), categories, schema, rules, information processing (and decision making), concepts, coding, transfer and retention (Lefrançois, 2000, pp. 195 - 209). The influence of the advances in computer technology is apparent. In fact, classical cognitivists work from a premise that that there is the non-physical equivalent of computer software in a person’s head capable of controlling behaviour. This view will be considered in greater detail in the next sections. Piaget’s theory differs from Bruner’s in that he mainly emphasises and describes a systematic approach to, and categorisation of, human cognitive development formulated from his detailed work with children (Lefrançois, 2000, pp. 209 - 233).

Cognitivism does not appear to provide the whole picture on cognitive processes. Without overlooking the enormous contributions cognitivist theories of learning have provided, the outstanding problem remains that the theories are largely detached from an understanding of human brain functioning, the site of human cognitive processes. Further, cognitivism is not linked to empirical evidence of how it is that human beings learn and by what processes. “Modern cognitive science” has sought to model the functioning of
the mind/brain and therefore provides an empirical base from which to gain an understanding of learning, a key aspect of this thesis.

4.4 Development of Cognitive Science Models of Learning

As the inner cognitive workings of humans cannot be observed, cognitive science seeks to understand human mental processes by studying simulations of human cognitive processes. In effect, cognitive science provides a major advance to understanding learning compared to the introspective theorising and observation of individuals. This Chapter will compare and contrast two current cognitive science models of learning with a view to providing a framework for understanding how people actually learn. To begin with, the adoption of a conceptualisation of "what makes a mind" is necessary to allow a comparison to be made constructively. The following section provides such an initial, basic conceptualisation of "mind".

4.5 A Basic Framework of Mind

As might be expected, there are a range of philosophical viewpoints on what constitutes "mind". The common argument centres on what is called the mind/body problem. The ontological nature of the mind/brain problem involves two distinct divisions in philosophical theorising. The materialist position regards the mind (non-material entity) and the brain (material entity)
as one whereas the dualist position regards the mind as something separate from the brain. Velmans (2000) notes that dualism is still defended by some modern scientists despite its irreconcilability with the natural laws of science as they are currently understood. In effect, there is a belief that consciousness/mind has a causal effect on brain functioning, in that the mind receives information from the senses and then controls the body through the exercise of will. According to Velmans, there are three reasons for the persistence of this view:

i. Bodies and brains seem to be very different from minds and consciousness. Arms and legs, for example, seem to be made of completely different ‘stuff’ to thoughts and feelings. No one can find consciousness by examining bits of the brain. It is intuitively plausible therefore to suggest that body and mind (or brain and consciousness) are different types of thing.

ii. There is extensive evidence that the body and brain affect mind and consciousness via the senses (for example, the visual system affects visual experience). There is also extensive evidence that the mind and consciousness affect the body and brain (for example, in the way that visual experiences or thoughts influence subsequent actions). It is
plausible therefore to suggest that mind and consciousness interact with body and brain.


Velmans distinguishes between “consciousness” and “mind”. He overcomes the difficulty of defining consciousness by alluding to situations where a person “is conscious of something as opposed to not being conscious of that thing”. In contrast, mind is linked to psychological processes that may or may not have conscious contents associated with them (Velmans, 2000, p. 16). Velmans argues that classical dualism does not offer an alternative to physical explanations of human functioning and that many scientists now believe a natural explanation of mind and consciousness is now possible (Velmans, 2000, p. 15 and p. 20). He identifies three ways in which philosophical argument has overcome the dualism debate:

i. Mind and physical matter might be aspects or arrangements of something more fundamental that is in itself neither mental nor physical (dual-aspect theory; neutral monism).

ii. Physical matter might be nothing more than a particular aspect or arrangement of mind (idealism).

iii. Mind might be nothing more than a particular aspect or arrangement of physical matter (physicalism; functionalism). (Velmans, 2000, p. 23).
According to Velmans, current western philosophy and science tend to favour the third account.

It is pertinent here to consider the work of Paul Churchland (1988) because he originated the general argument that basic philosophical issues can only be resolved through empirical investigation and therefore he seeks a natural explanation of mind and consciousness. Churchland (1988, p. 96) argues for a "bottom-up approach", formally referred to as methodological materialism. The bottom-up approach seeks to understand cognitive processes in terms of what occurs in the nervous system. Hence, rather than try and account for what human beings do by investigating possible underlying operations to explain cognitive activity, methodological materialism suggests that it is more productive to analyse the nervous system in fine detail for explanations of cognitive processes. In essence:

The conviction of methodological materialism is that if we set about to understand the physical, chemical, electrical, and developmental behaviour of neurons, and especially of systems of neurons, and the ways in which they exert control over one another and over behaviour, then we will be well on our way toward understanding everything there is to know about natural intelligence.

(Churchland, P. M., 1988, p. 97).
Churchland therefore argues that conscious intelligence must be considered against an understanding of biological evolution and the development of specialised nervous systems, in particular the human brain. (Churchland, P. M., 1988, pp. 123 - 142). In his view, human behaviour is...

...governed by as much by our past learning, and by our plans for the long-term future, as by our current perceptions. And through self-directed learning, the long-term development of the brain's internal organisation is to some extent under the control of the brain itself. (Churchland, P. M., 1988, p. 142).

Most importantly, Churchland describes how psychological phenomena may be explained in terms of neurochemical, neurophysiological and neuropsychological activities of the brain. Churchland argues that a real understanding of how cognitive capacities are produced can be deduced from a “pieced-together” functional map of the brain, together with detailed understandings of specific areas of the brain and how they function. Much of the empirical data comes from investigations of cases of various forms of brain dysfunction in which individuals may lose the ability to recognise colours, the ability to speak or the ability to recognise faces of close family members. However, Churchland warns that it is not necessarily the case that functional losses and functional localisations will always directly correspond to cognitive functions as they may be described in psychological terms. For
example, there are brain lesions that cause blindness and yet the victim will insist that they can see, while confabulating\textsuperscript{6} excuses for stumbling about a room (Churchland, P. M., 1988, p. 143 - 144).

As noted above, traditional behaviourists overcome the arguments concerning mind and mind processes by ignoring them. Behaviourism has subsequently been demonstrated not to explain fully the observed behaviours of animals and human beings. While cognitivists extended the argument to recognise that mental processes have to be considered in cognitive processes, their conception of what mental processes consist in do not appear to explain adequately all mental activities, such as skills incapable of being verbalised. Overall, Churchland’s (1988) argument is compelling because it links difficult philosophical issues to the need for empirical evidence. The accumulation of empirical evidence of mind/brain in the materialistic sense may even lead to objectivity being apportioned to psychological concepts such as belief, desire and consciousness. If it does not, then Churchland argues that the bottom-up approach to understanding mental processes and human behaviour offers the best platform on which to formulate new concepts (Churchland, P. M., 1988, p. 97).

\textsuperscript{6} Confabulation means to invent, rationalise or make things up. It is not make-believe or fibbing because the person believes their confabulation (see, Churchland, P. S., 1983, p. 93)
Recognising the complexities concerning matters of the mind, the following section provides a conception of mind, a touchstone of what mind “is” and “does”, before embarking on a consideration of “learning”.

Haugeland (1997) describes mind design as:

…the endeavour to understand mind (thinking, intellect) in terms of its design (how it is built, how it works). It amounts, therefore, to a kind of cognitive psychology. But it is oriented more toward the “how” than the “what”, than is traditional empirical psychology.

(Haugeland, 1997, p. 1, italics in original source).

As would be expected, the field of mind design is a complex study in itself. There are two highly influential approaches that relate to mind design that will serve to provide a framework of mind for present purposes. In understanding human representation and processing of visual information, Marr’s (1982) investigations are considered classic and influential (Thagard, 1998, p. 106; Stillings et al, 1995 p. 435; Leahey and Harris, 1997, p. 270).

In his detailed exposition, Marr (1982) adopted representational theories:
...that conceive of the mind as having access to systems of internal representations\(^7\); mental states are characterised by asserting what the internal representations currently specify, and mental processes by how such internal representations are obtained and how they interact.

(Marr, 1982, p. 6).

Marr (1982, pp. 23 - 25) found that it was not possible to gain an understanding of human vision ("what" it is and "how" it works) without taking into account three loosely coupled explicit levels of explanation. He takes an information processing point of view and argues that any information processing system needs to be examined at the three levels that he identifies as "computational theory", "algorithm" and "implementation".

The first level, "computational theory", is a precise specification of the goal or task. This may, for example, involve a process to add numbers together or to follow grammatical rules of language. This leads to the second level, "representation and algorithm", that is a specification of the representation for input and output together with the algorithm\(^8\) which provides the method for transformation. Continuing the two previous examples, the numbers to be

\(^7\) A representation is a formal system for making explicit certain entities or types of information, together with a specification of how the system does this (Marr, 1982, p. 20).

\(^8\) An algorithm is a computational procedure, usually involving a fixed series of steps, for arriving at the solution for some problem (Green et al, 1996, p. 368)
added are represented by symbols that represent a numerical value (the symbols convey a meaning). In the language example, a string of words (symbols) are the physical form of language and may be regarded as mapping a representation of meaning. Finally, the third level is a specification of the means of implementation. In the numerical domain the process of implementation involves the notion of the sum of the numbers, whereas in the linguistic example various rules and representations of grammar are involved. It is the integration of the three levels of explanation that provides the best empirical understanding of an information processing system (Marr, 1982, p. 329). Marr (1982) argues further, with particular reference to vision, that the “three levels of explanation” approach demonstrates that the main issues to be considered in an information processing system are the explicit representations used and the processes that create, maintain and interpret them (Marr, 1982, p. 330). Where there is good alignment between a computational theory, algorithm and implementation, and what actually occurs in the real world there is:

...good evidence that the constraints of the underlying computational theory are valid and may be implicit in the human processor...

...In the study both of representations and of processes, general problems are often suggested by everyday experience or by psychophysical or even neurophysiological findings of a quite
different nature. Such general observations can often lead to the formulation of a particular process or representational theory, specific examples of which can be programmed or subjected to detailed psychophysical testing. Once we have sufficient confidence in the correctness of the process or representation at this level, we can inquire about its detailed implementation, which involves the ultimate and very difficult problems of neurophysiology and neuroanatomy.

(Marr, 1982. p. 331).

Marr's (1982) research provides a clear, empirical understanding of the computational aspects of mind. However, to be complete, a framework of mind needs to include an explanation of what underpins behaviour that appears to occur automatically, without direct conscious intervention, as is demonstrated in the skilled driving of a car. In considering the acquisition of new skills, like learning to drive, Dreyfus (1992) describes the necessity for at first proceeding slowly, perhaps with initial clumsiness, and consciously following rules, push in the clutch, change the gear, let out the clutch, etc., in a mechanistic way. Usually a time eventuates where the skill can be performed automatically.

At this point we do not seem to be simply dropping these same rigid rules into unconsciousness; rather we seem to have picked
up the muscular gestalt which gives our behaviour a new flexibility and smoothness. The same hold for acquiring the skill of perception.

(Dreyfus, 1992, p. 248).

In this regard, Smolensky (1995a) provides an important expansion to Marr’s (1982) concept of mind, for he provides an explanation for the automatic behaviour described by Dreyfus. Smolensky distinguishes between two types of information processor. One involves conscious processes, the other unconscious processes. Where activities, tasks or problems are thought about consciously, Smolensky argues that this involves the engaging of the “conscious rule interpreter”. It is a “virtual machine” that applies interpretive rules to concepts that are consciously aligned with the activities, tasks or problems being addressed (Smolensky, 1995a, pp. 36 - 42). The notion of a conscious processor is demonstrated in the first attempts at learning to drive an automobile. The novice driver has to think consciously to press down the clutch, engage first gear, release the handbrake, engage the turning signals, turn the steering wheel, check the rear vision mirror, push down the accelerator and release the clutch before moving away from the curb.

As experience is gained and the skill of driving is mastered, the mechanical actions of driving tend to occur without conscious thought, to the point where the driving can occur concurrently while perhaps simultaneously enjoying the
scenery and some music. Smolensky posits that the automating of behaviour occurs due to another "virtual machine" called the "intuitive processor". He presumes that intuitive processor is:

... responsible for all of animal behaviour and a huge portion of human behaviour: perception, practiced motor behaviour, fluent linguistic behaviour, intuition in problem-solving and game-playing – in short, practically all skilled performance.

(Smolensky, 1995a, p. 37).

Thus, besides automatic, "mechanistic" skill-based behaviour, it is the intuitive processor that allows the identification of complex objects, such as a human face and its various expressions, and also the ability to distinguish between different faces. As Smolensky remarks:

Great computational power must be present in the intuitive processor to deal with the many cognitive processes that are extremely complex when described at the conceptual level


There appear to be conscious, rule-following, aspects of mind, together with unconscious, intuitive, aspects of mind functioning. In the case of skill acquisition, what were once conscious, rule following activities may become
“automatic” and not consciously thought about. Conversely, unconscious and intuitive mind events are not necessarily the result of conscious input, such as when a face is recognised.

Using the framework of mind encapsulated in the explanations of Marr (1982) and Smolensky (1995a) as touchstone, the following section considers artificial intelligence (AI). AI is:

...a branch of computer science which aims to make machines do the sorts of things that are done by human minds; its importance for cognitive science is in showing the considerable complexity and computational power involved in the most ordinary everyday achievements of the human mind.

(Green et al. 1996, p. 368).

4.6 Artificial Intelligence

Two scientists, von Neuman (1947) and Turing (1950), are generally credited with the basic theory of computation involved in artificial intelligence (cited in Green et al. 1996, pp. 31 - 34). A “Turing machine” has a memory in the form of recordable tape that can be examined and overwritten. It can perform any task that can be specified in algorithmic form (Green et al, 1996, p. 31). Processing in a von Neumann machine, representative of standard modern
computers, is based on a "fetch-instruction/execute-instruction" cycle that enable it to store and follow programs (Green et al., 1996, p. 32). Newell and Simon (1972) developed an alternative computing machine called production systems. A production system has a long term memory that contains rules (or productions) and a working memory containing a symbolic representation of the system’s current state. The rules specify when actions or changes to the working memory are required. Production systems as they relate to human problem solving were first introduced to psychology in the 1950's (for example see Newell, Shaw and Simon, 1958, pp. 151 - 166) and thereby gained status as the computation basis of cognition (Green et al., 1996, p. 33 - 34). The learning theories generated from this view of cognition envisage behaviour being kept in check by information processing according to identifiable rules. The basic assumption is that all thought processes, from Pavlovian conditioning to chess playing, may be represented in the form of manipulations of symbols such as letters, numbers, language, by conscious or unconscious rules. The emphasis is on the use of symbols as representations of the world and human beings as information processors, as explained by Newell:

The view that man is an information processor means that his behaviour can be seen as the result of a system consisting of memories containing discrete symbols and symbolic expressions (i.e., occurrences of symbols), and processes that manipulate
these symbols. The central notion is that of the symbol, which is to be taken to mean essentially what it does in computer science, an entity with a certain functional property, to wit: that when a process has a token of symbol it has access to information about what that symbol designates (encoded in symbolic expressions). The processes that can be on symbols are their creation (and, possibly, destruction), the obtaining of designated information, the creation of symbolic expressions, and the manipulation of these symbolic expressions by insertion, deletion, replacement, and ordering. A symbolic expression is a collection of symbolic tokens connected by relations of access – e.g., the tokens S,Y,M,B,O,L connected by the notion next, provides a token of the word SYMBOL.

(Newell, 1973, p. 27, italics in original source).

In this regard, Newell and Simon formulated the Physical Symbol System Hypothesis (PSSH) that equates human thought processes to the rule governed manipulation of symbols. Information from the external world is viewed as being encoded into internal symbols that may initiate action upon the environment (Simon, 1981, pp. 26 - 28).

The “tool of trade” of the classical cognitive scientist is the serial processing computer that incorporates a central processing unit. As might be expected, to
simulate cognitive processes such as learning it is necessary to program into
the serial processing system symbols that represent information, and the rules
by which the symbols are to be manipulated. Stillings et al (1995) describe
how such symbol manipulation is concerned with the “problem of what to do
next”. The computer programs have to be written, using appropriate
algorithms and observing the rules of machine language syntax, in a form of
ordered tasks and sub-tasks that specify the sequence of alternatives to be
considered to reach a defined goal or outcome. The aim is to reach the
intended goal (answer) efficiently by the best symbolically logical route by
considering all the symbolic alternatives. It is possible for the programs to
include heuristic techniques⁹ that narrow the search of what to do next by
identifying the best alternatives at different stages of the solution searching
process (Stillings et al. 1995, p. 177).

It is beyond the scope of this thesis to delve deeply into the detailed technical
aspects of artificial intelligence programs. It is, however, important to have a
“soft” appreciation of the technical aspects for the purposes of comparison
with alternative models. Diagrammatically the simplest representation of
artificial intelligence serial processing is in the form of a “tree”. A tree is a
compilation of “nodes” (junctions) from which emanate “branches” similar to
a hierarchical organisation structure in which everyone only has one
immediate superior (one example suggested by Stillings et al., 1995, p. 178).

⁹ A strategy or procedure for solving a problem which has high utility (it may be
quick and economical) but is not foolproof; a trial and error approach (Green et al.,
The tree represents all the possible alternative search moves and each node represents an intermediate stage in reaching the ultimate goal, which is to find the best solution to a problem, by systematic consideration of all the alternatives. There is a systematic transformation from an initial state to a goal state (Stillings et al., 1995, pp. 178 - 179). Understandably, artificial intelligence trees can become enormous so heuristic approaches to programming are adopted in such circumstances so that each alternative does not have to be considered separately. This is the means by which a level of control is introduced into the searching function alternatives of artificial intelligence programs (Stillings et al., 1995, p. 187).

According to Stillings et al., learning is “any process whereby a person or machine increases its knowledge or improves its skill” (Stillings et al., 1995, p. 192). They argue that learning is one of the most significant problems in artificial intelligence because it necessarily involves the complex factors of representation, search and control, as alluded to above, together with the difficulty of sustaining learning in an artificial intelligence system (Stillings et al., 1995, pp.192 - 193). Artificial intelligence learning systems have been demonstrated to learn by rote memorisation, learning from examples or analogy, and by being given directions (Stillings et al., 1995, p. 203). However, while a relatively small number of artificial intelligence programs are capable of learning, the majority are not (Leahey and Harris, 1997, p. 295). They can usually undertake complex computational tasks efficiently that
human beings find difficult, such as complex mathematical tasks, and complicated rule based activity as is found in chess games. Even so, they have not as yet performed tasks that human beings find relatively easy such as reading handwriting, recognising a dog or recognising a familiar face. The following section considers an alternate modelling system to artificial intelligence called connectionism.

4.7 Connectionism

During the last decade, enormous strides have been made in the understanding of the physiological bases of learning, memory and thinking through studying the human brain. Besides the biochemical and electrochemical reactions that form the basis of brain function, brain scanning techniques of functioning brains have been shown pictorially to reveal thoughts, memories, moods, fear, pleasure and new language acquisition in specific areas of the brain (for example see Carter, 1998). As a consequence of a better understanding of how the brain functions contemporary cognitive science has moved away from considering artificial intelligence as the only artificial model of learning and cognition. Connectionism is a more recent type of cognitive theorising than artificial intelligence and may be thought of as the "new cognitive science" (Evers and Lakomski, 2000, p. 8). It has resulted in learning models that mimic, to a limited extent, the neural synapses that occur in the brain.
Connectionism is most significantly different from artificial intelligence in that there is no central processing unit in computers that operate on a connectionist model of cognitive architecture. Connectionist models of learning may, however, be demonstrated on serial processing computers. In connectionism there are networks of interconnected processing units which can learn without being given specific rules, and knowledge is represented in patterns and strengths of the interconnections. Rather than serial processing found in artificial intelligence models of learning described above, connectionist computer models use a "fuzzier" kind of logic (see Kartalopoulous, 1996, pp. xx - xxi) called parallel distributed processing. This is recognised as resembling the structure and function of the brain. The advent of parallel distributed processing and its concurrence with psychological and biological phenomena is largely attributable to Rumelhart and McClelland (1986) and McClelland and Rumelhart (1987). The variety of terminology that is descriptive of connectionism includes: sub-symbolic model (paradigm), parallel distributed processing and artificial neural networks. Thus, connectionists view learning as a kind of synthesis of previous experience without necessarily following explicit rules. Learning is represented by changes in distributed patterns that represent information, similarly to the changes the brain shows via brain scans when activated by some type of stimulus. This occurs without the systematicity associated with artificial intelligence. Rather, it occurs by "the effect of slowly shifting harmony" \[10\]

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\[10\] Harmony refers to the inferences that can be drawn and "the goodness of fit", see Smolensky, 1995, pp. 73 – 77.
landscapes, adapting old and creating new concepts, categories and schemata” (Smolensky, 1995, p. 80). This forms the basis of the field of connectionism or a subsymbolic model of learning.

Connectionist networks, in general, make no assumption about representation. A “soft” technical understanding of connectionist parallel distributed processing would diagrammatically be represented by a set of multiply interconnected units (also referred to as nodes or artificial neurons) that are relatively simple computing units arranged in the form of a net, similar to a fine fishing net where the knots correspond to the computing units. The units are identical and thought-like processes change overall patterns in the artificial neural net as a whole. Interaction between the units is via the, generally, directed flow of activation along the connections. The units become more or less active according to the weight (or strength) of the connection(s) between them and are usually simultaneously stimulated and inhibited by many other units. There are various types of artificial neural networks, such as multilayered and modular, that can model different cognitive processes including the recognition and reconstruction of patterns (associative networks), Pavlovian-like conditioning (feed-forward networks), language analysis (recurrent networks) and story understanding (modular networks) (Green et al, 1996, pp.35 - 38). Fig. 5 provides some diagrammatic examples of types of artificial neural networks.
Thus neural networks have the ability to take into account many aspects of a situation that may be involved in a response or solution. In addition, artificial neural networks have been developed that have some capacity to take on properties associated with artificial intelligence, such as systematicity and compositionality\(^\text{11}\) (see Pollack, 1990).

According to Green \textit{et al}:

Learning (or training) within a connectionist network typically involves presenting the network with a series of patterns (the training set) and adjusting the weights on the connections in such a way that those patterns are somehow encoded in the network’s

\(^{11}\) Compositionality: the property of a representation that its meaning is a function of the meaning of its parts and their manner of combination (Green \textit{et al}, 1996, p. 370).
weights. Most algorithms involve only small adjustments to the weights on each trial, but require that the complete training set be presented numerous times (often in the order of thousands) before a reasonable degree of learning is achieved.

(Green et al, 1996, p. 39).

It follows that the complexity of the learning algorithm required is dependant on the type of cognitive process to be modelled and may involve, for example, back-propagation of error, a kind of trial and error learning. In a connectionist sense, then, learning is more about:

...the capacity of a system to absorb information from its environment without requiring some external intelligent agent to “program” it.

(Judd, 1990, p. 3).

Artificial neural nets do not simply produce outcomes that are expected. They also have the ability to suggest new alternatives or unpredictable results based on events in experience (McClelland, 1998, p. 159; McLeod et al, 1998, pp. 3 - 4). In addition, artificial neural nets exhibit properties like fault tolerance, interference, generalisation and graceful degradation of capacity, such as may be demonstrated by brain damaged patients (Green, 1996, pp. 39 - 40;
Rumelhart, 1996, pp. 152 - 153). Connectionist modelling is a relatively new field “still in progress” but there are a range of promising results.

Some examples follow to indicate the scope and possibilities of connectionist models. Some success has been achieved in developing connectionist models capable of learning concepts (Stillings et al, 1995, pp. 93 - 95), various language related functions (Stillings et al, 1995, pp. 389 - 391, 445 - 447), inference (Stillings et al, 1995, pp. 121 - 123) and a form of recognition of different human faces (McLeod et al, 1998, pp. 4 - 5) In terms of learning, McClelland (1998) has provided a detailed account of a connectionist model that learns about living things (McClelland, 1998, pp. 161 - 165), see Figure 5 on the following page.
Neural nets have also been developed that are capable of being trained to pronounce English words. Other neural nets are capable of distinguishing between sonar echoes of rocks and sonar echoes of mines (Churchland and Sejnowski, 1992, p. 114 - 115). A range of business applications of neural networks, including those capable of analysing financial statements and detecting payment card fraud, are considered in some detail by Lisboa et al (2000). Finally, as an example of the possibility of artificial neural nets communicating with each other, Quirolgico et al (1999) describe a framework that allows the communication of neural network knowledge between separate connectionist-based learning systems with an application to simulated aerial
reconnaissance of military objects that are moving (Quirolgico et al, 1999, pp. 242 - 254). Despite these impressive examples, it is important to note that connectionism is still a field in progress.

4.8 Some Technical Limitations

Both artificial intelligence and connectionist models of learning have their own technical difficulties. It is appropriate to have a general appreciation of the limitations of the cognitive science models of learning for they are, after all, models of learning – not the “real thing”. Artificial intelligence systems are restricted to functioning with explicit, symbol-based representations of knowledge and rule based information processing. According to Stillings et al (1995) in artificial intelligence learning systems, the initial results are directly dependent on the choices made for representation, search and control and this lead to the criticism that the outputs are already known by the system (Stillings et al, 1995, pp.192 - 193). Artificial intelligence systems are generally not fault tolerant. For example, where there is an error of syntax at any stage of the symbol manipulating program, the entire process is likely to be brought to a complete halt.

Connectionist networks also have a number of technical limitations. Leahy and Harris (1997) suggest that the most important concerns “catastrophic inference”. This occurs when an artificial neural network is retrained to learn
a completely different task from what it has previously learned. In the process of the learning it loses the ability to perform the task it first learned. Clearly, connectionist models only approximate the functioning of the human brain as humans do not lose the knowledge of acquired skills in the process of learning new ones (Leahey. 1997. p. 298). Another technical limitation concerns the use of back-propagation that may require thousands of learning presentations for what the brain can achieve in one experiential presentation (Green et al, 1996, p. 46).

4.9 The Artificial Intelligence/Connectionism Debate

It is evident from the above that artificial intelligence and connectionist models of learning each have strengths and weaknesses. Generally, artificial intelligence models of learning are strong at “thought processes” that involve systematic, compositional representations. Some connectionist models are also capable of using structured information together with “human brain-like” properties of graceful degradation and interference. However, the debate as to which model of learning is the best approximate model of human learning is far from settled. In part this is probably due to the fact that connectionism is a more recent field of endeavour than is artificial intelligence. As the previous sections have demonstrated, the debate concerning the best model of learning is as much about the architecture of mind and cognition as it is about learning. The relatively simple technically based information on artificial intelligence
and connectionism presented above belies the philosophical debate that has erupted in the pursuit of the understanding of learning (and mind).

The artificial intelligence/connectionism debate is well documented (see for example MacDonald and MacDonald, 1995; Dinsmore, 1992). There are two basic questions that need to be answered: i. Do humans learn, know and remember by storing screeds of words and sentences (symbols) that stand for something else? ii. Alternatively, are human cognitive processes changing patterns of activation that are constructed and reconstructed as required, with knowledge stored in connections rather than a central processing unit? In this section it is intended to provide a brief overview of the dispute in the context of seeking the best available model of learning at this time. To demonstrate some of the salient points of the artificial intelligence/connectionism debate Fodor and Pylyshyn (1995) provide suitable entry points arguing the case for artificial intelligence, while Smolensky (1995b) takes the affirmative for connectionism.

Fodor and Pylyshyn (1995) have been consistent, strong proponents of the artificial intelligence view of learning. In their view, classical cognitive scientists are not just committed to the “hard detail” of serial processing computers. They are steadfastly aligned with the Physical Symbol System Hypothesis, that is, to understand cognition involves the manipulation of symbols (Fodor and Pylyshyn, 1995, p. 91). They argue that connectionist
modelling is consistently representational despite the contrary view they perceive expressed in some of the literature such as Smolensky's (1995a) "sub-symbolic" interactions (Fodor and Pylyshyn, 1995, pp. 94 - 95). Hence, their view is that all arguments about cognitive architecture are rooted in representational states and processes (Fodor and Pylyshyn, 1995, p. 95) because classical cognitive theorists agree:

...neurons implement all cognitive process in precisely the same way: viz., by supporting the basic operations that are required for symbol-processing.

(Fodor and Pylyshyn, 1995, p. 96, italics in original source).

It appears that Fodor and Pylyshyn claim that representations in the form of symbols, together with semantic and syntactical properties, are necessary for all cognitive processes. The symbols structures and their compositionality forms, whether simple or complex, are assumed to correspond to real structures in the brain, and lead to specific behaviours (Fodor and Pylyshyn, 1995, pp. 98 - 99). It is on this basis that Fodor and Pylyshyn develop a highly critical account of connectionism. Following a detailed comparative analysis of connectionism from the Physical Symbol System Hypothesis point of view they argue against the connectionist model (Fodor and Pylyshyn. 1995, pp. 100 - 115).
Fodor and Pylyshyn (1995) use a long-standing point of contention regarding the productivity of thought that they claim connectionism is not capable of addressing. In essence, productivity of thought refers to the ability of humans to represent mentally an almost infinite number of thoughts when given only a finite number of concepts. Fodor and Pylyshyn argue that this can only be the case if thoughts are structured, semantically interpretable objects (Fodor and Pylyshyn, 1995, p. 116 - 119). There is a structural relationship and systematicity of cognitive representations because humans can systematically exchange like terms in sentential representations to create new mental representations – “the ability to produce/understand some sentences is intrinsically connected to the ability to produce/understand certain others” (Fodor and Pylyshyn, 1995, p. 120). Thus, where humans have the ability to think that “John loves the girl”, they are also able to think that “the girl loves John” (Fodor and Pylyshyn, 1995, pp. 121 - 122). Fodor and Pylyshyn regard connectionist models as inadequate because they do not demonstrate the level of systematicity they describe as fundamental (Fodor and Pylyshyn, 1995, p. 123).

A third point regarding classical cognitive theory that puts it at variance with connectionism concerns the compositional nature of classical cognitive representations. Fodor and Pylyshyn (1995) argue that the meaning of a sentential thought is derived from the meaning of its parts and the way they are combined (Fodor and Pylyshyn, 1995, pp. 123 - 129). Hence, a simplified
example is the thought that “John loves the girl”. It is a function of the meaning of thought “John”, the meaning of the thought “loves”, and the meaning of the thought “the girl”. The sentence “John loves the girl” demonstrates the compositionality of classical cognitive representations. According to Fodor and Pylyshyn, this is evidence that the mind is not a connectionist network because “compositionality requires combinatorial syntactic and semantic structure” (Fodor and Pylyshyn, 1995, p. 124). Finally, they argue that inference is rational and systematic (Fodor and Pylyshyn, 1995, p. 129 - 131). In their view, a connectionist model is “utterly indifferent” to these types of possibilities because there is no notion of logical syntax (Fodor and Pylyshyn, 1995, pp. 130 - 131, italics in original source).

With respect to the technical aspects of cognitive modelling, Fodor and Pylyshyn argue that most of the points made against classical cognitive models are unfounded. This is because, in their view, it is possible to have classical cognitive models that overcome the difficulties, or they can be implemented in such a way that the causes of concern can at least be reduced (Fodor and Pylyshyn, 1995, p. 136 - 143). They cite examples of proposals that connect serial processing computers into large parallel networks (Fodor and Pylyshyn, 1995, p. 138). More specifically criticising connectionism, they suggest that not much is gained by having cognitive models based on brain function if nothing is offered in the way of explaining “how it works” (Fodor and Pylyshyn, 1995, p. 144).
There appears to be one concession to connectionists by Fodor and Pylyshyn. They believe that there are empirical biological situations, such as vision (involving the receiving of light) and motor control (muscular activity), where it is reasonable to accept at the earliest stages, that there is "an anatomicallly distributed structure to be reflected by a distributed functional architecture" (Fodor and Pylyshyn, 1995, p. 145). The same cannot be said for an abstract cognitive process such as reasoning as there is no reason to expect the same relationship between structure and function (Fodor and Pylyshyn, 1995, p. 145). Rather than constituting a radical departure from the Physical-System System approach, Fodor and Pylyshyn (1995) argue that connectionism is a theory of implementation and that artificial neural nets are potential "implementation models" (Fodor and Pylyshyn, 1995, p. 147). In effect they summarise their position concerning connectionism thus:

...once one admits that there really are cognitive-level principles distinct from the (putative) architectural principles that connectionism articulates, there seems to be little left to argue about.

(Fodor and Pylyshyn, 1995, p. 147).

Smolensky (1995b) has been highly influential in the development of connectionism and replies directly to the arguments posited by Fodor and Pylyshyn (1995) above. Smolensky argues that there cannot be symbols that
are both mental representations and mental processes as is the case with the
cognitive architecture Fodor and Pylyshyn (1995) describe (Smolensky,
1995b, p. 167). He proposes a stronger definition of implementation by taking
into account higher-level phenomena (such as propositions) and lower-level
phenomena (such as sensory phenomena). He suggests the classical cognitivist
would include such phenomena as vision and motor skill in the latter category,
as Fodor and Pylyshyn (1995) do, and how they lead to an incomplete account
of cognitive processes (Smolensky, 1995b, pp. 16 - 168). Unlike classical
symbol manipulating models, Smolensky describes how connectionist models
have the ability to operate at two distinct levels – a lower-level that is the
formal algorithm that forms the activity of artificial neural net units, and a
higher-level (such as propositions) where large scale patterns (not
algorithmically describable) develop in the system. The lower-level may be
thought of as incorporating the syntax component, and the higher-level the
semantics. This is in stark contrast to the classical cognitive model in which
syntax and semantics are both representations and processes (Smolensky,

171 - 183) argues, in technical detail, that there is compositional structure in
the distributed representations typical of connectionist models, in the form of
a “family of distributed activity patterns”, therefore complex representations
such as propositions are made up from constituent representations
(Smolensky, 1995b, p. 174). He suggests that Fodor and Pylyshyn (1995) have mistakenly based their critical analysis of connectionism on the most simple of models of connectionism and the belief that artificial neural net units are generally representative of propositions in themselves. They thereby overlook the importance of the distributed nature of connectionist mental models (Smolensky, 1995b, p. 170 - 171).

It follows that the sentential language of thought advocated Fodor and Pylyshyn (1995) is not applicable to connectionist models. In fact:

...distributed representations provide a description of mental states with semantically interpretable constituents, but there is no complete, precise formal account of the construction of composites or of mental processes in that can be stated solely in terms of context-dependent semantically interpretable constituents.

(Smolensky, 1995b, pp. 184 - 185).

Connectionist models have emergent properties achievable by taking into account a lower level of analysis than is found in classical cognitive models. In fact, Smolensky argues that if connectionist models are analysed in sufficient detail, there are approximations to what occurs in classical symbol manipulation systems. Thus, connectionist models may include some
corresponding elements of symbolic computation (Smolensky, 1995b, p. 185 - 187). It is on this basis that Smolensky makes some concession to the classical cognitivist view (Smolensky, 1995b, p. 188). However, he is adamant that connectionism is not a repackaging of the classical cognitivism espoused by Fodor and Pylyshyn (1995).

Churchland (1980) argues that “There is no doubt that some of the information-bearing states of the central nervous system are not a species of sentential attitude…” (Churchland, P. S., 1980, p. 147). She analyses theory of language, intelligence and mental images and concludes that the sentential attitude should be abandoned except for superficial processing.

In a similar vein, Churchland (1998) responds to the more technically related criticism of connectionism levelled by Fodor (and others of like mind). He argues that connectionism does not simply equate to a new account of syntactic activities but more that:

Specifically, [connectionism] gives us an account of how distinct representational contents are systematically embodied in distinct cognitive vehicles. It gives us a detailed account of how those contents are causally related to proprietary aspects of the external world, both in perception and in action. It shows us how certain aspects of the world’s structure are mirrored in the relational
structure of our assembled representations; that is, it gives us some idea of how our background conceptual framework and specific activations within it *picture* both the global structure of the world and specific things and events within it. Furthermore, the theory gives us a detailed account of how those representations participate in a principled internal cognitive economy. It also provides a criterion for assigning the *same* contents to the representational vehicles of distinct individuals. It gives us, that is, a criterion for accurate translation across the representational/cognitive systems of distinct individuals. It may well be false, but it looks like a semantic theory to me.

(Churchland, P. M., 1998, p. 31, italics in original source).

The artificial intelligence/connectionism debate led some researchers to recognise the relative strengths of each type of modelling and to offer hybrid models (see for example Lange, 1992, pp. 237 - 289). However, on the basis of Churchland’s (1998) argument it seems reasonable to conclude that the connectionists have won the debate at this stage. This conclusion is further supported in the following section.
4.10 The Best Available Model of Learning

Tienson (1990) notes that despite the historical predations of what artificial intelligence would be capable of achieving in human-like cognitive processes the results have generally not been forthcoming (Tienson, 1990, p. 382). In his view, this has been brought about by a range of cognitive phenomena that have been ignored by the Physical Symbol System Hypothesis that is at the core of artificial intelligence. More specifically, he says that:

The problem is that it has thus far proven impossible to find the kinds of rules that GOFAI ("good old-fashioned artificial intelligence") requires.


According to Tienson (1990) there are two groups of problems that bedevil artificial intelligence. The first group includes the type of human feats that are computationally impossible to write as a program for a serial processing computer, what Tienson calls "multiple simultaneous soft constraints" (Tienson, 1990, p. 383).

Tienson’s notion of soft constraints can be illustrated in the observation of a competent chairperson who, while watching time constraints and the meeting agenda, also ensures that everyone has an opportunity to put a point of view,
that no one individual dominates proceedings, that unexpected developments are dealt with appropriately, and that useful business has been transacted by the end of the meeting. A large number of factors may come into play during meetings and yet a skilled chairperson can navigate immediately through unpredictable episodes without the meeting falling into disarray. A demonstration of the "softness" described by (Tienson, 1990) is evident in the situation that despite attempts at disrupting the meeting protocol it is still possible for the overall intended outcome(s) or goal(s) to be achieved. Thus, what the chairperson demonstrates in controlling the meeting is not necessarily explicit and describable in symbols. Much of it is implicit or unconscious knowledge and skill learned through experience.

The second group of problems that afflict artificial intelligence are in the realm of the human ability to extract relevant knowledge from the whole bank of knowledge possessed and combining it appropriately to suit the current situation and context. Tienson describes this capacity in terms of the situation where any piece "of commonsense knowledge might turn out to be relevant to any task or any other knowledge". Humans can quickly find and access relevant knowledge from a vast bank of knowledge, acquired as a consequence of experience in a variety of circumstances, and adapt it to suit a more current context (Tienson, 1990, p. 384 - 385). This necessarily involves determining what old beliefs are relevant at the time and then deciding whether the new information requires that the old beliefs need to be changed.
or not (Tienson, 1990, p. 385). The ability of humans to draw inferences in advance, and the combining of old and new knowledge occur without the necessity to search through every piece of stored knowledge is something that they can do all at once, virtually simultaneously. This stands in contrast to the artificial intelligence model of cognition that would have to specify a raft of rules in advance, for each piece of new information, that specify what knowledge would change or remain unchanged in any particular situation (Tienson, 1990, p. 385). In further contrast to artificial intelligence, humans are very good at finding and retrieving information when they need it and noting failures to do so as a matter of course. It appears, then, that humans have the ability simultaneously to find stored information and recognise it as relevant, hence, Tienson supports the notion of “content-addressable memory” and “relevance addressable memory”. Serial processing computers, on the other hand, display no such ability because information is retrieved from a strictly definable location or “address” (Tienson, 1990, pp. 385 - 386).

Bechtel (1990) notes the success that artificial intelligence has had in language processing and reasoning tasks, those activities that are amenable to rule-based programming, together with its limitations in addressing pattern recognition (Bechtel, 1990, p. 261). On this basis, he analyses the importance of pattern recognition as a cognitive task. He suggests that viewing symbols as tasks of pattern recognition would elevate pattern recognition to that of a central cognitive process (Bechtel, 1990, p. 263). Citing the work of Dreyfus

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and Dreyfus (1986), who distinguish between competent (rule-based) performance and expert (pattern recognition-based) performance, Bechtel suggests that pattern recognition may be a component of high-level reasoning tasks. The latter are generally considered the domain of artificial intelligence (Bechtel, 1990, p. 263). In addition, because connectionist models can produce patterns of activation based on previous experience, he detects a possibility of modelling content-addressable memory (Bechtel, 1990, p. 263). Bechtel also argues that artificial intelligence is largely incapable of taking into account the fluid nature of the notion of concepts that are held in human memory (Bechtel, 1990, p. 266).\(^\text{12}\) Rather than viewing them as "fixed units", Bechtel suggests that concepts in a connectionist sense may be constructed, reconstructed, or changed as the need arises in the form of patterns (Bechtel, 1990, p. 266).

In Bechtel’s (1990) view:

It seems reasonable at the current time to think of connectionist models as abstract accounts of the neural system...

...What might emerge as a result of connectionist perspectives is a repudiation of the view that there is one unique level for cognitive theorising but rather a view according to which

\(^{12}\) Indeed, classical cognitivists argue outright that concepts do not exist, see for example Fodor, 1998.
cognitive theorising (as well as neural) theorising occurs at a variety of levels, some of which are lower than the symbolic level of traditional cognitive theorising.

(Bechtel, 1990, p. 268).

Based on the evidence available, the connectionist view of learning appears to be a more plausible account for understanding learning. Artificial neural nets attempt to model real brain functioning which is characterised by massive interconnectivity and parallel distributed processing. Neural nets can also operate and learn without the constriction of rules. The fact that connectionist models, taking into account their limitations, learn at all is rather human-like. Connectionist models would appear to provide a richer framework for understanding human cognition, particularly in the realm of implicit or unconscious cognitive processes including learning. The importance of this was alluded to in the example of the skilled chairperson described above.

4.11 Summary

Initially, this Chapter provided an explanation of the complex philosophical context in which this thesis is grounded. Following an analysis of traditions of learning theory and models of learning, this Chapter has also shown that connectionism is the best model for human learning. In Chapter Five, expertise, implicit learning and connectionism are brought together.
Chapter Five:

Expertise, Individual Implicit Learning and Connectionism

5.1 Introduction

Explicit learning can be represented in symbolic form via verbal or written word, depends on conscious processing, is consciously accessible and obeys identifiable rules (see O’Brien-Malone, 1998 p. 37; Kirsner, 1998, pp. 7-8). Hence, the empirical evidence for explicit learning largely relies on the abilities of people actively to recall what has been learned which may be expressed verbally or in writing. However, not all learning is explicit.

The often cited examples of the skills of chess players and sportspeople suggest that explicit learning is only part of a more complete picture of learning. Chess players, for example, determine the best strategy based on their recognition of patterns on the chess board and the synthesis of previous experience without necessarily following “machine-like” logic to find the only correct solution. The process they apply utilises “fuzzy logic” that takes into account a range of factors and is implicit. Usually it is not possible accurately to express it symbolically. Fuzzy logic is closely associated with connectionist models of learning as described in Chapter Four. Similarly, master sportspeople can achieve incredible feats, such as a hole-in-one in golf, while being consciously unaware of precisely what they have learned from past experience to make the feat possible. Again, for the sportsperson to attempt to
verbalise what has been learned is virtually impossible due to the complex interactions that have occurred involving sight, muscles, nerves and neurons. The concept of intrinsic learning of chess players and sportspeople leads to how such learning may be applied to other human activities that involve mental and motor skills, such as may be found in a tailor’s workshop or manager’s office.

Initially, this Chapter sets out to provide a framework that demonstrates the important role that experience and expertise take in learning as the concepts of experience and expertise are difficult to represent in any explicit form. The notion of “implicit learning” is closely aligned with expertise and experience. Implicit learning is represented significantly in the literature. Therefore, a major proportion of this Chapter is devoted to developing an appreciation of the various viewpoints and complexities in understanding implicit learning. An important function of the Chapter is to seek empirical evidence of implicit learning. The Chapter also explores how implicit learning relates to, and how it may be distinguished from, explicit learning. Connectionism is found to be capable of modelling implicit learning and further, an amalgam of implicit and explicit components of learning as might be expected in expert performance.

5.2 Experience and Expertise

Lewicki, Czyzewski and Hill argue that professional skills and expertise in no small way result from experiential knowledge that is not reproducible in
symbolic form (Lewicki, Czyzewski and Hill, 1997, pp. 51 - 52). Dreyfus and
Dreyfus (1986) posit that expert (experienced) managers intuitively
understand and make decisions largely based on what has and has not worked
in the past. Rather than analytically applying rules to facts as a novice or a
computer might do, expert managers apply experienced-based understanding
to their various situations (Dreyfus and Dreyfus, 1986, pp. 159 - 160).
According to Dreyfus and Dreyfus (1996), people usually progress through
five stages of qualitatively different perceptions (proficiency) of a task or
mode of decision-making as skill performance is improved. The following
explanations are based on the Dreyfus Model of Skill Acquisition (Dreyfus
and Dreyfus, 1986, pp. 19 - 36) and they provide a useful framework on
which skilled behaviour is distinguishable from explicit knowledge.

In stage one of acquiring a new skill, a “novice” has no experience of the
situation and learns to recognise objective facts relevant to the skill and
acquires rules that can be used to determine action. There are abstract
principles (theory) and rule-governed behaviour to guide performance and
accumulate experience; actions are inflexible and limited in scope. A student
of management therefore learns theory of decision-making and applies it to
structured problems with a great deal of singularly focused concentration
(Dreyfus and Dreyfus, 1986, pp. 21 - 22).

“Advanced beginners” represent stage two of new skill acquisition. This stage
indicates that the learner has coped with real situations and recognises
relevant aspects to new situations that are viewed more and more as a complete whole. There is a perception of similarity to prior experiences that cannot necessarily be articulated by the learner. Consequently, the advanced beginner manager learns by experience more facts and more sophisticated rules that could be applied to decisions that are to be made (Dreyfus and Dreyfus, 1986, pp. 22 - 23).

In Stage three, “competence”, learners face an almost overwhelming number of relevant aspects and a sense of what is significant is absent. To cope, people learn (or are taught) to devise a plan to bring some form of structure to the situation and then determine what is relevant to improve their performance. The learner conceives of their actions more in terms of long-range goals or plans of which they are consciously aware. The advanced beginner manager consequently has a greater sense of responsibility for outcomes because they are not simply a result of applying learned rules and procedures. The choice of plan is based on considerable conscious, reflective and analytical contemplation of a situation (Dreyfus and Dreyfus, 1986, pp. 23 - 27).

“Proficiency” represents stage four of skill development. Characteristically the proficient performer perceives situations holistically and demonstrates an intuitive ability, “know-how”, to recognise patterns based on past experiences. Hence a proficient manager intuitively understands and organises the task at
hand while still thinking analytically about what to do (Dreyfus and Dreyfus, 1986, 27 - 30).

Stage five of skill development represents “expertise”. The expert performer learns from experience what events might be expected in a particular situation and how plans need to be modified, based on the most salient factors, to respond to the current circumstances. Hence, the performance of expert managers is more “fluid” and they tend to do what normally works. Rather than deliberate, analytical problem-solving an expert manager reflects critically on intuitions. They are capable of making judgements based on their prior concrete experiences that challenge the best attempts at explanation (Dreyfus and Dreyfus, 1986, pp. 30 - 35).

Dreyfus and Dreyfus (1986) posit that the significant point of their Skills Acquisition Model is that there is a progression from analytic behaviour to decompose a situation/environment into recognisable elements consciously and the following of abstract rules. “to involved skilled behaviour based on the holistic pairing of new situations with associated responses produced by successful experiences in similar situations”. Ultimately, the best performance of a subject “will result from the intuitive use of holistic discrimination and association” (Dreyfus and Dreyfus, 1986, p. 35)

Dreyfus and Dreyfus (1986) argue that the “art” of management has been generally lost due to the predominance of formal models that fail to capture
human expertise (Dreyfus and Dreyfus, 1986, pp. 158 - 192). In a similar vein, Reed (1996) concludes that there is too much reliance on indirect knowledge gained from secondary experience and insufficient attention given to primary, first-hand, experience. It is not that there is anything intrinsically wrong with processed information. Reed argues, it is that there is a skew towards symbol manipulation processes at the expense of human beings experiencing things for themselves (Reed, 1996, pp. 1 - 2).

The meaning of second-hand experience derives from and is dependent on primary experience. Processed information has value and meaning, but the value and meaning emerge precisely because of the relation between the processed information and its sources, not because of any meaning intrinsic in the processed information itself. (Reed, 1996, p. 3).

Similarly to Dreyfus and Dreyfus (1986), Reed is critical of the effect the symbol manipulation models have had on organisations and management, and consequently on employees. In Reed’s view, manager’s and organisations are over-reliant on “speed, repetition, and certainty” to the detriment of the wisdom that develops from experiences that result from complex human behaviour such as change, uncertainty and the making of difficult choices (Reed, 1996, 68 - 91).
It is clear that experience plays a crucial role in learning and that there is an intuitive, though implicit and inexplicable, aspect to knowledge and learning that cannot be easily represented. Consequently, any complete investigation into the field of learning needs to consider research concerned with the concept of implicit learning. This is the topic of the next section.

5.3 Implicit Learning

In 1993 Berry and Dienes (1993) argued that confusion had arisen in the literature over the use of the term “implicit learning” and how it is distinguishable from explicit learning. They noted that the distinction was blurred because some authors view implicit learning in terms of a way of acquiring knowledge while others conceived of it as the whole research area (Berry and Dienes, 1993, p. 2). The authors identify three conceptually linked areas to implicit learning: perception without awareness, implicit memory and automatic processing. Berry and Dienes (1993) argue that the relationship between the areas is characterised by:

...whether or not actual stimuli, or the links between them, are consciously perceived, and whether these stimuli, or links, are consciously remembered or not.

(Berry and Dienes, 1993, p. 3).
In the case of perception without awareness, experiments have been constructed in which subjects are not consciously aware that a stimulus has been presented to them and yet they demonstrate an effect of the experience. In contrast, subjects in implicit memory experiments are usually consciously aware of the stimuli, show an effect of the experience but are unaware of the learning process that took place (Berry and Dienes, 1993, pp. 2 - 10). Automatic processing differs by being concerned with the conscious perception of links between stimuli or stimuli and actions that are afterwards forgotten. General characteristics of automatic processes are: they are fast, unavoidable and unstoppable, unavailable to consciousness and they do not reduce the capacity for performing other tasks. As automaticity develops through prolonged practice and knowledge accumulates, it has been suggested that a “practiced” individual is capable of more rapid retrieval of relevant information and its application than would be the case with an “unpracticed” individual, who would necessarily have deliberately applied thought processes (Berry and Dienes, 1993, p. 10 - 13).

Consequently, Berry and Dienes (1993) identify four key features of the performance of implicit learning tasks:

i. Transfer specificity is a central characteristic of implicit learning and it implies a level of inflexibility to be applied across domains.

ii. Implicit learning tends to be associated with incidental learning situations rather than explicit theory testing.
iii. A sense of intuitiveness in arriving at answers is often associated with implicit learning.

iv. Implicit knowledge needs to be robust in terms of retention, psychological insult, and storage and retrieval.

(modified extract from, Berry and Dienes, 1993, pp. 13 - 16).

Unlike explicit learning, defining implicit learning is a difficult task. Frensch (1998) suggests that:

As interest in a given concept increases within the research community, thus, the number of meanings attached to the concept increases as well.


After an analysis of the many definitions offered in the literature for implicit learning Frensch notes that most definitions differ by whether they emphasise learning processes or learning and retrieval processes. Added to this is whether “implicit” is taken to be tantamount to “unconscious” or “non-intentional” (Frensch, 1998, p. 96). Applying the scientific criteria of operationalisability, uniqueness and predictive value to the concept of implicit learning, Frensch concludes that the preferred meaning to be attached to implicit learning is that of a learning process that occurs nonintentionally. Consequently, Frensch recommends that the definition of the concept of implicit learning is:
...the nonintentional, automatic acquisition of knowledge about
structural relations between objects or events.

(Frensch, 1998, p. 76).

The results of experiments designed to test empirically this definition of
implicit learning indeed confirmed that it has predictive value (Frensch, 1998,
pp. 77 - 94). Additionally, the experiments demonstrated that it was probable
that implicit learning occurred unintentionally. However, preferences for
learning particular types of functional relations (preparedness) were evident
that may reflect constraints of the cognitive system itself (Frensch, 1998, p.
94).

The empirical investigation of implicit learning and unconscious knowledge
developed in the 1960’s (see Reber, 1993, pp. 10 - 13, and pp. 26 - 72).
Typically, the investigations involve subjects being presented with symbol
strings, some of which adhere to complex grammatical rules, and the subjects
are tested on grammatical knowledge acquired about the strings without being
informed of the rules. This usually involves an “implicit test” (grammaticality
judgement of strings) and an “explicit test” (such as a free recall verbal report
of known rules). Statistical analysis allows the determination of whether
subjects have learned some of an underlying grammatical structure (rules)
substantially above chance. The pattern of results is known as the “logic of
dissociation”. To this day, artificial grammar learning experiments are still
widely used in the study of brain damaged or brain disease patients as a way
of developing an understanding of what is involved in learning processes. Other experimental methods used in the investigation of implicit learning typically utilise various other types of performance activity indexes, including the use of interactive tasks and serial pattern learning (see O'Brien-Malone, 1998, pp.39 - 42). The commonality between the methods described is that a person learns about the structure of a relatively complex task, without necessarily intending to do so, and the acquired knowledge is difficult to express (Berry and Dienes, 1993, pp. 1 - 2). Despite implicit learning research having been in existence for some thirty years there are still differing schools of thought. Berry (1997) identifies two continuing, fundamental areas of debate within the implicit learning literature: i. whether or not implicit learning results in abstract knowledge and, ii. whether or not implicit knowledge is unconsciously acquired (Berry, 1997, p. 3). A sub-debate on

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13 For example, citing the work of Reber (1976, 1989). Berry (1997) notes that he claims:

...that implicit learning is an unconscious abstraction process that gives rise to abstract knowledge...This type of abstraction model presumes that individuals abstract structural or featural information from training exemplars and store this information as a high level generalisation.

(Berry, 1997, p. 4).

Berry (1997) contrasts Reber’s view with that of Brooks and Vookey (1991) and Neal and Hesketh (1997), who, in summary suggest:

...that decisions about category membership of novel items are based solely on retrieval of information about specific exemplars rather than on more abstract information...classification decisions are guided by similarity of test items to stored exemplars (or parts of them).

(Berry, 1997, p. 4).

Berry (1997) notes that Reber changed his claim of the unconscious nature of implicit knowledge when evidence for the opposite was demonstrated. This lead to Reber (1989) adopting the position that “knowledge acquired from implicit learning processes is knowledge that, in some raw fashion, is always ahead of the capacity of its processor to explicate it” (Reber, 1989, p. 229, cited in Berry, 1997, p. 5).
whether or not implicitly acquired knowledge can be consciously accessed is also evident in the literature, this will become apparent in the following analyses.

Mathews and Roussel (1997) argue that given “that people know more than they can tell”¹⁴ is a characteristic of implicit learning there is a need to separate implicit learning from the issue of conscious access to implicitly acquired knowledge. They note that some researchers reject the notion of implicit learning because they have demonstrated conscious accessibility of “implicit knowledge”. However, Mathews and Roussel argue that these researchers are likely to have been able to demonstrate people’s conscious awareness of some (fragments of) implicit knowledge more through experimental designs and processes rather than being a true illustration. To distinguish between implicit and explicit learning, Mathews and Roussel posit that:

…the main point is that conscious thought beyond encoding the exemplars (e.g. problem solving, hypothesis testing) is not for developing implicit knowledge of the structure inherent in the stimuli. The fact that one type of knowledge is relatively more verbalisable is interesting, but not essential to the existence of two different learning processes.

(Mathews and Roussel, 1997, p. 15)

¹⁴ This topic is considered in detail in Chapter Six.
Mathews and Roussel argue that implicit learning could result in three types of knowledge, all closely aligned with experience. First, humans are able to acquire procedural knowledge unconsciously as a result of acting in response to specific environmental factors and previously acquired procedural knowledge. This, they suggest, is demonstrable in the ability of humans to navigate their way around their environment or ride a bicycle without deliberately developing models of what is required to achieve their objective. Such procedural knowledge is not verbalisable, hence, its acquisition is only apparent through direct observation of the task being achieved. Mathews and Roussel suggest that some implicit learning may be dependent on higher level systems of knowledge by referring to the results of artificial grammar learning investigations of brain degeneration patients. For example, there is evidence that degeneration of the brain area associated with procedural learning does not preclude artificial grammar learning by patients (Mathews and Roussel, 1997, p. 19).

Secondly, according to Mathews and Roussel, episodic knowledge in which the recall of similar events is applied to new situations, could be acquired as a result of implicit learning. This is a contentious suggestion, however, as Mathews and Roussel note themselves, in that artificial grammar learning studies of amnesic patients have demonstrated that they may have reduced episodic memory while retaining implicit learning ability (Mathews and Roussel, 1997, p. 19). The third type of knowledge that may result from implicit learning is mimetic in character. Mathews and Roussel argue that
mimetic representations develop as a result of episodic memory and experience, and are at least partially consciously accessible in a situation similar to, but not the same as, the initial stimuli and possibly open to conscious mental computation (Mathews and Roussel, 1997, pp. 19 - 20).

Following analysis of a condition-action, artificial grammar rule-based learning task (Mathews and Roussel, 1997, pp. 24 - 41), Mathews and Roussel conclude that while implicit learning involves non-conscious acquisition, fragments of implicitly acquired knowledge are consciously accessible, i.e. they are explicit, and are therefore representable in an abstract form at any time. Mathews and Roussel regard this as a distinct advantage over trying to use connectionist models of learning and knowledge that would be distributed as a pattern across an artificial neural network. The knowledge fragments acquired may be partial rules capable of being used as a means to guide behaviour in new situations (Mathews and Roussell, 1997, p. 41 - 43). The role of explicit learning (reflective), according to Mathews and Roussel, is to weave the knowledge fragments acquired implicitly (experientially) into a coherent story. They suggest that it is through the “knowledge weaving process” that dissociations between what people say they are doing and their actual behaviour\(^\text{15}\) is explained (Mathews and Roussel, 1997, p. 42).

\(^{15}\) Argyris and Schön (1996) refer to this as espoused theories and theories-in-use, respectively.
In direct contrast to Mathews and Roussel, Lewicki, Czyzewska and Hill (1997) argue for the entirely non-conscious nature of implicit learning. They suggest that the “observation of everyday life” provides the best evidence for the entirely non-conscious quality and uniqueness of implicit learning processes. They argue that there are many skills (procedural knowledge) that are acquired without conscious awareness, are not consciously accessible and yet are necessary to function successfully in everyday life (Lewicki, Czyzewska and Hill, 1997, p. 48). Lewicki, Czyzewska and Hill describe the results of experimental investigations that demonstrate how knowledge structures can be acquired unconsciously without people knowing that such structures exist (Lewicki, Czyzewska and Hill, 1997, pp. 48 - 53). Experiments in which groups of subjects were asked to decide on the age or attractiveness of people represented in poor quality photographs, thereby reducing the effect of stereotypical attributes, demonstrated high rates of agreement, however, the subjects could not articulate what their decision was based on. In the view of Lewicki, Czyzewska and Hill:

Such experiments, easy to perform in informal settings, illustrate an implicit (but highly specific and probably algorithmic in nature) knowledge that must have been acquired outside of conscious awareness and which represents one of the most commonly used tools of one’s everyday interaction with the environment.

(Lewicki, Czyzewska and Hill, 1997, p. 49)
Language attainment and speech production are further examples of non-conscious knowledge according to Lewicki, Czyzewska and Hill (1997, p. 50). For example they refer to the ability of most people to distinguish phrases that “sound better” according to the order that the words are assembled without necessarily being cognizant of the specific syntactic, semantic or grammatical rules that may apply. Lewicki, Czyzewska and Hill suggest that studies of language development in children demonstrate that the rules of language are “abstracted” from people’s experience and are “acquired in the form of specific algorithms of information processing” (Lewicki, Czyzewska and Hill, 1997, pp. 50 - 51).

Lewicki, Czyzewska and Hili argue that elements of professional expertise also encapsulate knowledge that is acquired unconsciously (Lewicki, Czyzewska and Hill, 1997, pp. 51 - 52). They describe how some procedural knowledge can only be derived from experience. Such knowledge is only definable in terms of outcomes achieved rather than being representable in some explicit abstract form. For example, the process of interpreting radiographs, is a skill that has been found impossible to transfer to computer programming, even in a preliminary sense (Lewicki, Czyzewska and Hill, 1997, p. 52). Similarly, the skills of good managers who achieve desirable outcomes go beyond their explicit (and necessary) knowledge of their particular situation. These cannot be set down as specific rules (Lewicki, Czyzewska and Hill, 1997, p. 52).
Drawing from their research on the development of individual differences, Lewicki, Czyzewska and Hill conclude that:

i. The human cognitive system is capable of non-consciously detecting even subtle, “hidden” (an often incidental) covariations between features or events in the environments.

ii. Memory representations of these covariations trigger the development of encoding algorithms that influence (and possibly bias) the acquisition of new language.

iii. In many circumstances, even if they were initiated incidentally (and are not ‘true’) these encoding biases can gradually strengthen and develop in a self-perpetuating manner into strong and durable dispositions (i.e. relatively independent from the objective nature of the environment).

(Lewicki, Czyzewska and Hill, 1997, p. 55, italics in original source).

Manza and Reber (1997) posit that the accumulated literature concerning artificial grammar learning supports the position that implicit knowledge bases can develop in experimental subjects that can enable them to accomplish problem solving, decision making and the encoding of new stimuli. According to Manza and Reber there are three possible forms of mental representation that could apply. The “abstractive view” proposes that
an artificial grammar mental representation is an abstract representation of the precise stimulus features largely devoid of any specific information (Manza and Reber 1997, p. 75). The "distributive (or exemplar-based) view" suggests that artificial grammar mental representations that are linked become literal, coded first-hand experiences that are stored and used for comparison to, and encoding of, new stimuli (Manza and Reber, 1997, p. 76). Sharing some similarities with the distributive view, the "fragmentary view" of artificial grammar mental representations proposes that pattern-related fragments of original stimuli, closely tied to the physical form of the stimuli, are coded and stored (Manza and Reber, 1997, p. 76).

From this foundation Manza and Reber attempt to demonstrate the form of the mental representation that applies to implicitly learned knowledge through a series of artificial grammar learning experiments involving transfer of knowledge. In almost all of the experiments, Manza and Reber found evidence to support the abstractionist, distributive and fragmentary views of mental representation of implicitly acquired knowledge (Manza and Reber, 1997, pp. 79 - 99). Thus, the researchers conclude that artificial grammar based knowledge is not represented in only one manner, rather it is represented in a complex multifaceted form, where one may dominate over others dependent on the learning context and the form in which information is originally provided (Manza and Reber, 1997, p. 99).
The transfer of knowledge in artificial grammar learning is also investigated by Dienes and Altman (1997). They initially report on investigations that have tended to demonstrate that conscious knowledge is not necessarily flexibly utilised by people, though provision of some guidance and facilitation can improve the outcomes possible. Even with such direct assistance provided, Dienes and Altman describe further evidence that suggests that performance is dependent on the level of experience or expertise of the subjects involved, as might be expected in comparing a novice professional and a highly experienced professional or expert (Dienes and Altman, 1997, pp. 107 - 108).

The experience of an expert provides the opportunity for an accumulation of knowledge that is not necessarily all within conscious reach and Dienes and Altman answer the question of how this knowledge is acquired in the first place by using a model of expert knowledge acquisition (Dienes and Altman, 1997, pp.108 - 109).

In considering how experts acquire knowledge, Dienes and Altman (1997, pp.108 - 109) refer to the Singley and Anderson (1989) model. The model suggests that expert knowledge develops from an initial explicit (declarative) knowledge base that is applied to relevant problems. As a result of applying the explicit knowledge a bank of unconscious knowledge is constructed that can be applied (transferred) to finding solutions to subsequent problems to the extent that they are relatable. Hence, according to the Singley and Anderson Model, the transferability of unconscious problem solving knowledge is limited, to some extent, to the similarity of the realm of a particular problem.
being considered to past experiences and perceptual detail. (Dienes and Altman, 1997, pp.108 - 109).

Dienes and Altman use artificial grammar learning experiments to explore empirically the extent to which unconsciously acquired knowledge can be applied in a flexible way, such as might be the case when a known solution to one problem or situation could be applied to another problem or situation in a comparable way (Dienes and Altman, 1997, p. 107). The experimental results obtained demonstrated that artificial grammar knowledge is limited in its transferability across two knowledge domains, therefore it is relatively inflexible, and is partly perceptually bound. The flexible component is indeed "quite unconscious" (Dienes and Altman, 1997, p.120).

Perruchet and Gallego (1997) provide a direct contrast to the preceding accounts of implicit learning by arguing against conventional accounts of implicit learning. They define implicit learning:

...as an adaptive mode in which subjects’ behaviour is sensitive to the structural features of a previously presented situation, without this adaption being due to the intentional exploitation of subjects’ explicit knowledge of these features.

(Perruchet and Gallego, 1997, p. 155).
In their view, “there is no place for implicit knowledge or implicit representations” (Perruchet and Gallego, 1997, p. 155). This major conclusion is largely based on the authors’ analyses of artificial grammar learning experimental results and a proposed “subjective unit account” of implicit learning (Perruchet and Gallego, 1997, p. 125; pp. 128 - 152). At the crux of the subjective unit account are the following factors:

i. People process complex material by itemising (parsing) it into non-overlapping units in a way that the smallest possible number of different units is formed as training progresses, reliant on automatic associative phenomena.

ii. Implicit learning generates conscious perceptual units (not implicit representations) that shape the phenomenal experience of the world and are directly responsible for performance improvement in conventional implicit learning tasks.

iii. With training, conscious perceptual units become increasingly independent of sensory input and form explicit representations that could be combined to allow intentional analysis of complex, real world settings.

iv. Learning situations that involve genuine abstraction cannot be accounted for by implicit processes as abstraction requires conscious forms of thought. In general, however, by making possible the perception and the
explicit representation of the relevant units (possibly in a hierarchical format), unconscious associative processes prepare people for an intentional analysis of the structure of the world.

(modified extract, Perruchet and Gallego, 1997, p. 155)

Thus, Perruchet and Gallego argue perceptual contents, and representations developed from perceptual contents, are consciously accessible. However, the processes involved are unconscious physiological phenomena consistent with associative mechanisms attributed to brain functioning (Perruchet and Gallego, 1997, p. 155). In this regard Perruchet and Gallego argue that connectionist models of implicit learning are applicable due to the associative links they describe. However, they suggest that non-connectionist models probably accord better with the subjective unit account of implicit learning because of the possibility of overlapping in connectionist models (Perruchet and Gallego, 1997, pp. 146 - 147). They conceive that conscious and unconscious phenomena, while closely interconnected, are intrinsically different. As a result there is no gradual transition from unconscious to conscious phenomena and no portrayal possible of implicit knowledge as explicit knowledge (Perruchet and Gallego, 1997, p. 156).

St. John and Shanks (1997) also reject traditional accounts of implicit learning. They argue that implicit learning is not an unconscious process by elucidating inherent flaws in the experimental methods commonly used to
demonstrate implicit knowledge, that is, the logic of dissociation (St. John and Shanks, 1997, pp. 164 - 171). For example, the limitations of relying on verbal reports of conscious knowledge of artificial grammar learning experiments overlook the possibility of subjects not reporting potentially verbalisable knowledge because they are not confident of the soundness of their judgement. Hence, St. John and Shanks conclude that the conscious/unconscious debate is not helpful in distinguishing between implicit and explicit knowledge. Rather, they propose that it is more profitable to consider explicit learning and implicit learning as two distinct “information processing systems” that provide different information (St. John and Shanks, 1997, p. 172).

Subsequently the results of an experiment designed to test information processing of artificial grammar conducted by St. John and Shanks (1997, pp. 173 - 188) suggest that subjects consciously store salient encoded superficial fragmentary information rather than abstract rules in a superpositional memory system (St. Jahn and Shanks, 1997, p. 189), consistent with connectionist models of learning (St. John and Shanks, 1997, p. 175). An extension of the experiment to determine if limitations exist to the types of regularities that an implicit learning system can learn found that contiguous artificial grammar regularities were learned better than non-contiguous artificial grammar regularities (St. John and Shanks, 1997, p. 189). Hence, the authors conclude that implicit learning is a process of “conscious fragment...
memorisation", but also recognise that the role of consciousness requires further investigation (St. John and Shanks, 1997, p. 190 - 191).

Whittlesea and Wright (1997) provide experimental results, based on artificial grammar investigative processes, which suggest subjects impose organisation on structured stimuli based on prior knowledge rather than passively acquiring it (Whittlesea and Wright, 1997, p. 183 - 185). Additionally, they found that subjects exerted considerable flexibility over what components of the stimuli they responded to and how they organised those components as they learned about them, though in all probability not consciously at the time of learning. Hence, according to Whittlesea and Wright (1997) the implicit aspects of learning concerned the choices being made to process the stimuli in one particular way rather than another (Whittlesea and Wright, 1997, p. 189 - 190). They argue that it is erroneous to divide implicit learning into abstractive and encoding modes, rather:

...in the act of learning, either implicitly or explicitly, people impose some organisation on the structure of the stimulus and form a representation of that structure as organised on that occasion.

(Whittlesea and Wright, 1997, p.190).

Particularly in respect of implicit learning, Whittlesea and Wright suggest that organisation is subject to such factors as the familiarity of the stimulus, the
difficulty and understanding of the task, and the differential attention paid to particular parts of the task based on prior knowledge or immediately prior experience of the stimuli (Whittlesea and Wright, 1997, p.190). They further conclude that the transfer of implicitly acquired knowledge to new situations is as dependent on the organisation that a subject applies to the stimuli as it is on the stimuli itself (Whittlesea and Wright, 1997, p. 195).

Whittlesea and Wright argue that there is only learning, not the two types of learning, implicit and explicit, that have generally been accepted. In their view, there are implicit and explicit aspects during every instance of learning. Therefore, they contend that while subjects are always aware of the stimulus (a physical thing, sensation or idea) in the sense of its relationship to their performance, they will frequently be unaware of some of the characteristics of the stimuli such as the sources of control of past experience, the content of learning or how the learning might apply to new circumstances (Whittlesea and Wright, 1997, p. 196).

O’Brien-Malone and Maybery (1998) examine the issue of the unconscious nature of implicit learning in considerable detail. The authors note the variations in meanings attached to the concept of consciousness but adopt the notion that it is “the capacity to play a causal role in the inner workings of oneself” and that implicit learning is an unconscious process of knowledge acquisition “in the absence of conscious, reflective strategies to learn”, a position attributed to Reber (1992, p. 113, cited in O’Brien-Malone and
Maybery, 1998, p. 42). From this position, O'Brien-Malone and Maybery analyse the purported characteristics of implicit learning via three commonly used experimental methodologies, namely, artificial grammars, interactive tasks and serial pattern learning.

With respect to the "unconscious" aspect of implicit learning supposed in the experimental methodologies, O'Brien-Malone and Maybery conclude that there is little evidence to support the notion that implicit knowledge is inaccessible because there is consistently some valid knowledge conveyed by subjects involved in the experiments (O'Brien-Malone and Maybery, 1998, p. 47). The analysis of the "unintentional" aspect of implicit learning suggests that subjects may acquire knowledge without the intention to learn, however, there is not a strong instantiation of an unintended-learning condition (O'Brien-Malone and Maybery, 1998, p. 48).

O'Brien-Malone and Maybery suggest that there are two other characteristics that may bear on the professed unconscious nature of implicit learning which are: i. invulnerability to the manipulation of attentional resources, and ii. robustness to neuropsychological disorders. The analysis of the ability of current methodologies used in implicit learning experiments to substantiate these characteristics presents ambiguous results to date (O'Brien-Malone and Maybery, 1998, pp. 51 - 54). Consequently, Malone and Maybery refute the unconscious nature of implicit learning but do not rule out "possible access" of implicitly acquired knowledge.
Berry and Dienes (1993) assess a range of experimental approaches used in the research of implicit learning in part by applying the characteristics above. First they consider whether there is evidence for a distinction between implicit and explicit modes of learning in relation to the control of complex systems. In relation to the accessibility of implicit knowledge, Berry and Dienes found that the dissociation between task performance and verifiable knowledge is not as marked as originally thought, as people appear to develop some explicit knowledge as a result of extensive practice and experience (Berry and Dienes, 1993, p. 26). They also provide evidence of the existence for two distinct modes of learning: one which is implicit (unselective) and unlikely to produce verifiable knowledge and the other being explicit (selective). Most notably, the authors found that forcing people to adopt an explicit learning approach to a normally implicit learning oriented task decreased overall performance (Berry and Dienes, 1993, p. 28). Berry and Dienes therefore argue that it is likely that any complex learning task involves a subtle, variable combination of implicit and explicit learning processes. They also concluded that the relative specificity of implicit knowledge limits its transferability to other situations (Berry and Dienes, 1993, p. 30 - 33).

Dienes (1993) critiques investigations of implicit concept formation, such as appears to occur when people distinguish between grammatical and non-grammatical sentences without necessarily being able to articulate the rules of grammar they are applying, or when a medical diagnosis is made without necessarily being able to verbalise all the factors taken into account to arrive
at the decision (Dienes, 1993, p. 37). The evidence, based on artificial grammar learning and other models, suggests that subjects do acquire non-rule based, non-verbalisable concepts during particular incidents of experience that have an intuitive sensation attached to them (Dienes, 1993, p. 60). In the particular case of concept formation in sequence learning activities Dienes and Berry (1993) similarly found that the knowledge acquired was not easily expressed and that subjects appeared to be unaware that a core structure even existed (Dienes and Berry, 1993, p. 80).

As the summaries above suggest, whether implicit learning happens consciously or unconsciously, results in consciously accessible knowledge (whether whole or fragmentary) and is abstractly representable are questions for extended arguments for some time to come given the divergent views expressed in the literature. However, there appears to be no argument that there is no such thing as implicit learning. The concept of implicit learning is therefore highly significant, as it promotes the idea that people are learning all of the time, perhaps simply through a facial expression or bodily gesture that defies symbolic representation. It therefore seems reasonable to conclude that there is a distinction between implicit learning and explicit learning. More importantly, the conclusion can be reached that learning, the acquisition of knowledge, is a complex fusion of implicit and explicit learning processes.
5.4 Distinguishing Between Implicit and Explicit Learning

At the crux of making a distinction between implicit and explicit learning are
concepts of representation, and pattern recognition and completion. As
mentioned at the beginning of this Chapter, the symbolic tradition of
knowledge representation is closely linked to the Physical Symbol System
Hypothesis that assumes that all knowledge can be represented in symbolic
form, such as by sentences and propositions. The cognitivist influence on
administrative theory is demonstrated in theories that claim cognitive tasks
such as learning, decision-making and planning can be understood in terms of
three stages:

i. …devise a symbolic way of representing objects and events
   in the world that can be physically encoded into a machine
   the way (for example) a computer program can be.

ii. …arrange for the machine to operate on its stored symbols
    according to a set of rules which are also stored, to produce
    further symbolic structures some of which may be termed
    outputs.

iii. …connect the output in such a way that it is evidenced by
    behaviour.

(Evers and Lakomski, 2000, p. 11).
The emphasis is on understanding cognitive processes in terms of the properties of symbolic representations have led to the development of such management systems as “optimisation techniques, critical path analysis, maximisation of expected utility under conditions of uncertainty, actuarial risk analysis” (Evers and Lakomski, 2000, p. 11). Thus, cognitivism, as it may be applied to management, has at its core the idea that appropriate human behaviour can result from learning administrative/management theory (symbolic/linguistic strings that represent administrative situations), processing the content in a particular situation, and arriving at a logical outcome/behaviour (Evers and Lakomski, 2000, p. 11).

Evers and Lakomski (2000) identify important limitations to a traditional cognitivist account of learning:

i. There are clearly difficulties in formulating sentences (programs) for all the things that matter, for example in administrative life.

ii. For many decision-making processes there is no symbolic representation possible, such as behaviour that results from “skill” that cannot be captured in language.

iii. There is a failure to recognise the fusion of symbolic and non-symbolic knowledge in the skilled (professional) performance and human judgements.

(modified extract, Evers and Lakomski, 2000, p. 13).
As it is evident that there are forms of knowledge that cannot be expressed symbolically, in their analysis, Evers and Lakomski conclude that in traditional cognitivism “knowledge is conflated with a model of knowledge representation, and theory with theory formulation” and “accounts of knowledge, decision, and training that fail to recognise this point end up with a chronic problem over how to understand the relationship between theory and practice” (Evers and Lakomski, 1996, p.108). The relationship between theory and practice, in philosophical terms, is described as the distinction between “knowing that” and “knowing how” (see Eiser, 1994, pp. 122 - 126).

In Chapter Four, two models of learning were compared and critiqued. It was found that artificial neural net models provided the best current account of learning particularly because of their similarity to brain functioning. In this regard, neural nets may be used to clarify the distinction between implicit and explicit learning in terms of an understanding of knowledge that includes theoretical and practical aspects. Simply put:

From a network point of view, there is no physical difference in the representation of “knowing that” and “knowing how”. All the knowledge a neural network possesses is located in its geometry and connection weights.

It may similarly be stated that there is no physical difference in the representation of "explicit" and "implicit" knowledge. As previously described, neural networks make no assumption about representation, store knowledge as patterns of activity, can complete incomplete patterns, and learn from experience without rules. Together with the fact that neural nets can achieve various language related functions, it is apparent that neural nets may also utilise sentential representations of important facts. "Knowledge" thought of in terms of the alteration of patterns of activity as new information is provided to an artificial neural network or a brain, tends to overcome the confusion of knowledge with representation, and the inability to represent practical knowledge, that is prevalent in the cognitivist account of learning. Thus, the functioning of artificial neural nets suggests that the implicit learning associated with a particular complex learning experience may be separately, or concurrently, linked to explicit learning.

In an organisational context, for example, it is possible to think of situations in which a manager has to deal with people who are in conflict with their manager. The manager may deal with the problem by referring to formal, explicitly expressed conflict resolution strategies in tandem with experiential knowledge gleaned from implicit learning from relevant past experience adapted to suit the current situation. In effect, the perceived pattern of behaviour the manager thinks needs to be adopted is a form of pattern completion to determine appropriate behaviour that amalgamates explicit and implicit elements of learning. As Chapter Four demonstrated that
connectionism provides the best available model of learning, in the following section neural net/connectionist models of learning are used as a means to try and understand what it means to learn implicitly and to acquire implicit knowledge. This, however, is not intended to convey the notion that neural nets are limited only to the “unconscious” and the “implicit”. Chapter Four demonstrated that neural nets are also capable of “explicit” processes.

5.5 Implicit Learning and Connectionism

Dienes (1993) examined computational models of implicit learning, including classifier systems, exemplar models and connectionist models. It was found that all of the models stored knowledge that was difficult to extract explicitly. There was the possibility, however, that the stored knowledge might be available in the event of using forced-choice testing procedures, as is the case with human subjects (Dienes, 1993, p. 110). In 1996, Dienes and Perner argued that viewing subject’s knowledge as based on a connectionist model of learning in particular suggests that a subjective threshold of consciousness separates different types of knowledge and that representations of the knowledge used by the network are not objects of knowledge themselves, hence the knowledge is not accessible. However, connectionist networks are also outstanding at completing patterns and providing explicit information when cued, which is suggestive of a mechanism that may occur in subjects when placed in a situation of forced recall (Dienes and Perner, 1996, p. 252 - 253).
Connectionism is gaining prominence as a model of learning due to its similarity to brain functioning. Artificial neural networks are capable of human language processing. They have added to the viability of connectionist models of cognition more generally. See for example Christiansen and Chater, (1999a, 1999b); Gaskell and Marslen-Wilson, (1999); Plunkett and Juola, (1999); Tabor and Tanenhaus, (1999); Dell, Chang and Griffin, (1999); Plaut, (1999); Smolensky, (1999); Steedman, (1999) and Dienes, Altman and Gao, (1999). The emphasis in the literature on symbol manipulation based learning models is clearly being challenged as are the theories of consciousness. For example, O’Brien and Opie (1999) argue against the traditional symbol manipulation model of learning and posit a computational theory of consciousness based on connectionism that:

...suggests that instantaneous consciousness is not a single, monolithic state, but a complex amalgam of distinct and relatively independent phenomenal elements. Consequently, it also suggests that our on-going consciousness is not a single stream, but a mass of tributaries running in parallel, and it suggests that we are conscious of a good deal more information at any one moment in time than theorists have traditionally supposed.

(O’Brien and Opie, 1999, p. 146).
The authors suggest that most of the existing empirical evidence for implicit learning is flawed (O'Brien and Opie, 1999, pp. 131 - 133) and that consciousness is the explicit encoding of information in the brain rather than complex information processing, thus ruling out the possibility of unconscious representation (O'Brien and Opie, 1999, p. 146). Cleermans and Jiménez (1999) support the use of a connectionist framework to conceptualise the distinction between explicit and implicit cognitive processes but are critical of the reliance on stable representations as a medium for conscious awareness suggested by O'Brien and Opie (1999). The former argue that there are stable patterns in the human body we are incapable of becoming aware of, for example the pattern of activation of light receptor cells in the eye, and that stability is insufficient to support phenomenal experience (Cleermans and Jiménez, 1999, p. 151). Cleermans and Jiménez (1999) suggest that:

...patterns of activation in connectionist networks are continuously causally efficacious, whether stable or not, and do not of themselves generate phenomenal experience. Rather, they are potentially available to consciousness depending on other factors such as stability, strength, global coherence, access by some other structure, or their compositional and systematic character. The genuinely hard problem is then to determine how such patterns can become symbolic, explicit, and conscious, that is, how they can be taken by the cognitive system as
representations. (Cleeremans and Jiménez, 1999, p. 152, italics in original source).

Cleeremans (1997) proposes that:

At a given time, knowledge is implicit when it can influence processing without possessing in and of itself the properties that would enable it to be an object of representation. Implicit learning is the process by which we acquire such knowledge. (Cleeremans, 1997, p. 199).

According to Cleeremans much of the debate concerning implicit learning, as demonstrated in most of the preceding accounts, is misguided. He argues that the differing opinions is a result of the dominance of the artificial intelligence model of learning (symbol manipulation) according to identifiable rules (Cleeremans, 1997, pp. 198 - 199). Thus, there is a longstanding theoretical position that supports the notion of a cognitive unconscious that is symbolic, rule-based, containing abstract knowledge. The main problem, Cleeremans contends, is the fact that implicit knowledge cannot be represented using systems based on symbolic representations (Cleeremans, 1997, p. 199). In his view, the implicit/abstractionist theory (see above) emerged largely to support the notion that cognitive processes are about symbol manipulation. This notion, however, has been discredited to some extent because non-reportable unconscious rules in a rule-based system (by definition) are an enigma
(Cleeremans, 1997, p. 205). Similarly, Cleeremans argues that the
dissociations observed between performance and explicit knowledge as
applied to the explicit/associationist theory of implicit learning (see St. John
and Shanks above) are misleading. This is because of the inadequacy of the
tests used to measure implicit and explicit knowledge, rather than
demonstrating that there is a separate implicit learning system (Cleeremans,
1997, p. 206). Cleeremans demonstrates that the empirical methods aligned
with both the implicit/abstractionist and explicit/associationist theories of
implicit learning are so closely intertwined with the symbol manipulation
model of learning that complexity of the phenomena is inadequately taken
into account, simplistic assumptions are made about measurable behaviour
and the mechanisms that bring the behaviour about (Cleeremans, 1997, pp.
208 - 224).

According to Cleeremans, connectionist models provide a superior framework
for understanding the mechanisms involved in implicit learning (Cleeremans,
1997, pp. 225 - 229, see also Cleeremans, 1993). He argues that implicit
knowledge is best understood as implied knowledge similarly to the way
linguistic presuppositions may imply different representations to different
listeners. Consequently, using Cleeremans’ example, the explicit statement
“John paid the bill” causes listeners to make some determinations about
John’s sex, age and financial standing, and to begin to surmise whether John
is in a restaurant, shop or police station. The listeners are “primed” but not
directly aware of all the implications of what is heard explicitly, though this
can change as subsequent information becomes available (Cleeremans, 1997, pp. 226 - 227). Hence, knowledge one is not directly aware of at some point in time is brought to bear on subsequent processing. (Cleeremans, 1997, p. 227).

On the basis of results of experimental investigations in which subjects were exposed to almost infinite “noisy” finite-state sequential choice stimulus material, Cleeremans (1997) found that while it seems implausible to think that subjects could somehow consciously encode and memorise sequences, the data in fact demonstrated that this was the case. What is more, there was no evidence of conscious accessibility to the distributional information concerning the stimulus material. According to Cleeremans, evidence of conscious accessibility is unimportant as it provides no further enlightenment about the learning process in any case (Cleeremans, 1997, p. 227). He argues that because crucial distributional information is represented spontaneously during processing in connectionist networks this provides a clear explanation as to how knowledge can be implicit, and nonetheless influential in processing mechanisms, while not being representable itself: an outcome problematic for symbol-based models (Cleeremans, 1997, pp. 227 - 228).

It seems clear that connectionist frameworks provide a rich conception of implicit knowledge and implicit learning and are demonstrating the capability to include the procedural, non-symbolic, non-verbal activities that are characteristic of everyday life, expertise and practice. Hence, in connectionist accounts “knowing” is predicated on experience such that there is
interdependence between the self and the world. In addition, there is a social aspect to learning and knowing. In this regard, St. Julien (1997) adopted connectionist and sociocultural insights and applied them to the teaching of biological cell categorisations to students. He compared the results with more traditional instruction approaches. The traditional approach required students to memorise a list of distinctive features (rules), having seen representations of specific categories, to allow them to classify cells according to their perception of the presence or absence of particular cellular features according to the rules that they had “in their heads”. The connectionist approach to learning the cell categorisations was experientially-based in a social context. This approach required the students first to recognise patterns of similarities and differences in examples of cells and this was then enhanced to a more complex understanding through interaction with the instructor. It was found that students prepared on the basis of connectionist and social interaction principles performed considerably better than those prepared in the traditional way (St. Julien, 1997, pp.269 - 277). In St. Julien’s view, the experiment suggests that people learn most effectively when engaged in activities that involve perceptual learning “that is mediated by socially organised practices that situate knowledge in the world” (St. Julien, 1997, p. 272).

The above findings of Cleermans (1997), in particular, suggest a necessity to more fully consider the role that implicit/tacit knowledge has in the functioning of human beings. St. Julien’s (1997) experimental outcomes are suggestive of a need to change the focus that human cognition rests solely in
an individual head to a view that cognition is distributed among individuals and socially constructed.

5.6 Summary

Chapter Five has argued that implicit learning exists and can be distinguished from explicit learning. However, it has also shown that learning may be a fusion of symbolic and non-symbolic knowledge. Connectionism is found to be capable of modelling implicit (and explicit) learning. The crucial finding is that the learning process appears to be an amalgam of implicit patterns and explicit components.

The thesis argument, so far, has tended to concentrate on individual learning. Chapter Six will consider tacit knowledge as the concepts of learning and knowledge are so closely related. It is suggested that tacit knowledge is an extension to the notion of expertise and implicit learning. Chapter Six also begins the necessary transition from individual considerations to collective or organisational considerations of learning and knowledge.
Chapter Six:  

The Continuum of Organisational Tacit and Explicit Knowledge

6.1 Introduction

Polyani (1967) offers a perspective on human knowledge that suggests humans “know more than [they] can tell” (Polyani, 1967, p. 4). This seems to be demonstrated in the difficulty that people have describing a known person’s face in words, and yet, a familiar face can be recognised with relative ease. Polyani (1967) argues that the tacit nature of knowing includes things such as problems, hunches, skills, and the use of tools, probes, denotative language, face recognition, and the recognition of external objects through bodily senses (Polyani, 1967, p. 29).

In a similar vein, Baumard (1999) posits:

Behind both purposeful and unintentional ambiguities lies a knowledge that cannot be articulated or stabilised. On the one hand it is implicit knowledge, that is something we might know, but do not wish to express. On the other hand, it is tacit knowledge, that is something that we know but cannot express (Baumard, 1999, p. 2).
Spender (1996) argues that tacit knowledge has been described in two ways. It has been described in terms of that which is gained experientially or in terms of its incommunicability and personal quality. In his view it is:

...the kind of knowledge we pick up by “osmosis” when we join a new organisation or take up a new activity, and on which our sense of domain mastery is based.


Tacit knowledge, then, clearly needs to be considered in a complete analysis of learning. In some respects a consideration of tacit knowledge is an extension to the notion of expertise and implicit learning discussed in Chapter Five, as the concepts of learning and knowledge are so closely related. The human capacity, for example, to walk, play a sport, drive a car, dance, or make a musical instrument, involves knowledge that is not readily recalled and put into words. The following sections will investigate the notion of tacit knowledge from both an individual and collectivity or organisational perspective. This Chapter initially seeks the empirical evidence for tacit knowledge then proceeds to review the role of tacit knowledge in organisational settings as it is described in the literature. The inherent difficulty in extracting tacit knowledge is demonstrated.
6.2 Physiological Evidence of Tacit Knowledge

A common source of the evidence of tacit knowledge may be found in the neuropsychological investigations and experiments that have been concerned with various forms of dementia, such as Alzheimer’s disease, Huntington’s and Parkinson’s disease, multiple sclerosis, and head trauma. In fact enormous strides have been made in understanding the role of specific parts of the brain by studying such patients, together with experiments on animals, birds and invertebrates (see Squire and Nelson, 1992). The distinction between tacit and explicit knowledge has been readily demonstrated in studies of amnesiac patients. Such studies often involve the investigation of implicit and explicit memories.\textsuperscript{16} Many amnesiacs lose explicit knowledge of who they are or names and addresses, for example, and yet they retain motor skills. Lefrançois (2000) cites studies that demonstrate amnesiacs (and patients with Alzheimer’s disease) do well on tasks on implicit memory while demonstrating impairment on recall of explicit learning. They are also capable of being conditioned in the classical sense (they are able to learn new behaviours) but have no memory of the conditioning process itself (Lefrançois, 2000, pp. 271 - 272).

\textsuperscript{16} Memory has been defined as “the storage and retention of information, knowledge, or skills” (Green et al, 1996, p. 376). In memory research explicit memory (knowledge) is also known as “declarative memory” and similarly, implicit memory is also known as “nondeclarative memory” (Lefrançois, 2000, p. 271).
Leahey and Harris (1997) describe typical experiments that are used in the study of amnesia patients that are similar to artificial grammar learning previously referred to in Chapter 5. Subjects do particularly poorly when they learn a list of words and are then tested for recall in a traditional way. However, when subjects learn a list of words and some weeks later are presented with word fragments of the original list to complete, without being told of the connection:

They are more likely than controls to complete the word fragments if the fragments make words that were on the earlier list, and if the fragments have more than one solution, they are more likely than controls to complete the fragment with a word from the earlier list.

(Leahey and Harris. 1997, p. 309).

Other experiments have shown that simple tachistoscopic\(^{17}\) exposure to a word in some way “primes” that word in memory so that it is more accessible than other words (Leahey and Harris. p. 309).

The study of amnesiacs has provided a framework for understanding tacit knowledge. However, it is important to extend the understanding to “healthy”

\(^{17}\) Very brief, measured exposure of objects, such as words, to the eye using an instrument called a tachistoscope.
human beings if the significance of tacit knowledge is to be fully appreciated and this is the objective of the following section.

6.3 Knowing More Than Can Be Told

By way of introduction to the development of an understanding of tacit knowledge, Polyani (1967) briefly describes psychological experiments (not conducted by him) performed in the late 1940's and 1950's that provide evidence for his notion of people “knowing more than they can tell” noted above. In one experiment, a person was presented with nonsense syllables. On presentation of certain of the syllables the person experienced an electric shock under the control of the researchers.\footnote{Research Ethics Committees would have some difficulty in approving these experiments today!} Over time, the subject demonstrated symptoms of anticipation of an electric shock merely at the sight of “shock syllables”, however, on completion of the experiment, the subject could not identify the syllables that would lead to an electric shock. A variant of the preceding experiment involved a person being subject to an electric shock when he expressed associations to particular words. In this case, the subject learned to avoid the shock by not expressing the associations, however, the subject could not explain how the avoidance was being achieved. In Polyani's view, the experiments provided clear evidence of people knowing more than they could articulate words (Polyani, 1967, pp. 7 -
8). Contemporary investigations, as will be described in the following pages, build on the work of Polanyi and lead to a more sophisticated understanding of tacit knowledge.

The feeling of knowing something that cannot be adequately expressed in words is part of the human condition. Hence, a manager knows how to deal with a perplexing organisational situation and yet has difficulty expressing it because the activity involves a complex interaction of explicit and experiential knowledge. Koriat (1993) studied the “feeling of knowing”. He particularly considers three areas namely, the predictive validity of feeling-of-knowing, the process underlying feeling-of-knowing judgements, and the basis for feeling-of-knowing accuracy (Koriat, 1993, pp. 609 - 615). Koriat describes a process model of the feeling-of-knowing that focuses on the effects of accessibility at the expense of the content of the information. A core assumption of the model is that feeling-of-knowing depends on the accessibility of partial information, regardless of its correctness. In Koriat’s view, the factors of accessibility are the amount of information and the ease of access (Koriat, 1993, p. 615). Three experiments were conducted using the model devised by Koriat. Using “healthy” subjects, Koriat conducted experiments similar to those described in assessing amnesiac patients described above. In the first experiment he tested memorising nonsense letter

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19 This lead Polanyi to suggest that the basic structure of tacit knowledge involved two kinds or “terms” of knowing, for example, identifying the mood expressed on a face relies on the awareness of the features of a face and the signs of a particular mood (Polanyi, 1967, pp. 9 - 10).
strings, recall, feeling-of-knowing judgements, and testing of recognition memory (Koriat, 1993, pp. 617 - 623). A second set of experiments used longer nonsense letter strings, the interval before recall was increased, and the time taken for subjects to initiate recall was noted (Koriat, 1993, pp. 623 - 627). Experiment 3 explored whether partially accessible information pertains to the target as a whole, rather than fragments of the target (Koriat, 1993, pp. 627 - 629).

Koriat found that a critical factor affecting feeling-of knowing was the sheer accessibility of information, not its accuracy (Koriat, 1993, p. 630). Further, he suggests that feeling-of-knowing judgements are generally accurate, dependent upon the overall accuracy of the accessible information, the amount of information available, and the ease of access. The core issue raised by Koriat is whether people can monitor the contents of their memory and whether they have privileged access to an internal directory where iraccessible information is directly available. He proposes that people have no privileged access to the presence of information in store but must infer their feeling-of-knowing from the products of their memory (Koriat, 1993, pp. 633). Clearly, Koriat’s findings raise important questions about whether subjective reports of judgements and decisions faithfully reflect the internal mental processes of individuals.

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20 Koriat argues that, “in general, items committed to memory are more likely to give rise to correct than to incorrect recall” (Koriat, 1993, p. 631).
A comprehensive review and analysis of experiments that attempt to determine people’s knowledge of the workings of their own mind is provided by Nisbett and Wilson (1977). On their analysis of investigations into people’s verbal reports on cognitive processes in dissonance and attribution studies\(^{21}\), it was concluded that the explanations given by people to explain their behaviour were far removed from what the investigators presumed had occurred, such that there is considerable doubt that the subjects had direct access to their cognitive processes (Nisbett and Wilson, 1977, pp. 233 - 238).

Nisbett and Wilson extended their analysis to include the literature concerned with: the learning-without-awareness, subject ability to report on weights they assign to stimulus factors in complex judgement tasks, subliminal perception, and stimuli influencing problem solving. They also considered awareness of the effect of the presence of other people on helping behaviour. Following their analysis the authors reach the conclusion that people have little ability to provide accurate reports on the cognitive processes they undertake (Nisbett and Wilson, 1977, pp. 239 - 241).

\(^{21}\) Dissonance research refers to experiments in which “behaviour that is intrinsically undesirable will, when performed for inadequate extrinsic reasons, will be seen as more attractive than when performed for adequate extrinsic reasons”. Thus, where a person has done something unpleasant without sufficient justification, the person reports in a way that avoids psychosocial discomfort (Nisbett and Wilson, 1977, p. 233).

Attribution research involves people striving “to discover the causes of attitudinal, emotional, and behavioural responses (their own and others)...[where] the resulting causal attributions are a chief determinant of a host of additional attitudinal and behavioural effects”. Thus if a person receives a recommendation for a product, they will undertake a casual analyses of the reasons an individual gives the recommendation (Nisbett and Wilson, 1977, p. 233).
In their own related investigations, Nisbett and Wilson also demonstrated the inability of subjects to report accurately on the effects of stimuli on responses. The experiments were designed to have the following criteria in mind:

i. The cognitive processes studied were of a routine sort that occur frequently in daily life. Deception was used minimally, and in only a few of the studies.

ii. Studies were designed to sample a wide range of behavioural domains, including evaluations, judgements, choices, and predictions.

iii. Care was taken to establish that subjects were thoroughly cognisant of the existence of both the critical stimulus and their own responses.

iv. With few exceptions, the critical stimuli were verbal in nature, thus reducing the possibility that subjects could be cognisant of the role of the critical stimulus but simply unable to describe it verbally.

v. Most of the stimulus situations were designed to be as little ego-involving as possible so that subjects would not be motivated on grounds of social desirability or self-esteem maintenance to assert or deny the role of particular stimuli in influencing their responses.

(Nisbett and Wilson, 1977, p. 242).
The subjects were virtually never accurate in their reports of their cognitive processes (Nisbett and Wilson, 1977, p. 242). In addition, it was found that people who read verbal descriptions of the experiments, but did not participate, were found to give similar reports to the experimental subjects. Nisbett and Wilson posit that this suggests that a similar source is drawn upon whether an active participant in the experiments or an "observer" (Nisbett and Wilson, 1997, pp. 247 - 248).

These results lead Nisbett and Wilson to suggest that people "tell more than [they] can know". Thus,

...people sometimes make assertions about mental events to which they have no access and these assertions may bear little resemblance to the actual events.

(Nisbett and Wilson, 1977, p. 247).

Nisbett and Wilson subsequently propose that people apply or generate causal theories, or judgements, about the plausibility of their response fitting the stimuli they experienced. The origins of the causal theories may result from culturally explicit rules, or implied theories, that stipulate an appropriate response, empirical observation, or connotative associations with similar situations (Nisbett and Wilson, 1977, p. 248). In Nisbett and Wilson’s view, subjects may have felt that they were being introspective in reporting on their
cognitive processes when in fact they were applying a simple judgement of plausibility (Nisbett and Wilson, 1977, p. 249). The feeling of certainty in subjects who believe that they have access to their cognitive processes may be causal possibilities that are small in number, particularly accessible, highly plausible or observed to have been relevant in the past. However, Nisbett and Wilson (1977) argue that the illusion of awareness is probably due to such factors as confusion between content and process, inadequate feedback or motivational reasons (Nisbett and Wilson, 1977, pp. 255 - 257). They conclude:

...though people may not be able to observe directly their cognitive processes, they will sometimes be able to report accurately about them. Accurate reports will occur when influential stimuli are salient and are plausible causes of the responses they produce, and will not occur when stimuli are not salient or are not plausible causes.

(Nisbett and Wilson, 1977, p. 231).

Nisbett and Wilson’s investigations support the arguments of Patricia Churchland. As a result of her comprehensive analysis of physiological evidence of tacit knowledge, Churchland (1983) concluded that introspection, the examining of one’s own mental processes or thoughts, is much more unreliable than is generally realised (Churchland, P. S., 1983, p. 83). In her
view, what is taken as a person’s “access to their own mind” usually amounts to confabulation, the rationalising and inventing of plausible explanations, because much of what is regarded as intelligent activity belies being expressed in words. Such confabulation is not regarded as pathological as it seems to be the normal way that people theorise about their and other peoples’ behaviour (Churchland, P. S., 1983, pp. 83 - 84). Confabulations are fabrications of a person’s mind that may or may not relate to something in the real world, they are used in the way people conduct business as a matter of course. Put another way, confabulations are individual “theoretical entities” that result from a brain interacting with the environment and, probably, other brains too. Hence, the accuracy of accessible information issue raised by Koriat (1993) above can, at best, be only understood in terms of confabulations that individuals construct.

In this regard, Churchland argues that verbal competence or linguistic representations are not the language of thoughts or knowledge; however, she recognises that there are important conceptual associations between thought, knowledge and language (Churchland, P. S., 1983, p. 86). In her view, it is highly implausible that an organism must have a language in order to form representations because:

...artful and complex orienting and communicative behaviour suggests that nonverbal organisms have a cognitive map of the
environment, preference and decision structures and learning routines, and they have the representational wherewithal to permit them complex interaction with their own and sometimes other species, where such interaction often includes a division of labour and a recognition of individuals as individuals. (Churchland, P.S., 1983, p. 87).

Hence, language is important to the extent that it allows learning of theories, however, it does not fully represent the cognitive ability or knowledge of humans. As discussed in Chapter Five, explicit or symbolically-based knowledge is but part of a whole picture of knowledge. Knowledge also includes practical or experiential elements, such as knowing how to do something, that is never represented in symbolic form and therefore remains tacit. At best, it may be possible to demonstrate tacit knowledge in a way that may cause learning through observation and extracting patterns of activity without any form of “sentence-crunching” being involved.

Therefore, tacit knowledge is largely personal, difficult to convey and not easily codified in language. The inability of people to express all of their knowledge accurately in words has important implications in the context of groups of people. For example, when a person’s words do not correspond to their actions the ground is set for uncertainty and “trouble”. In the next section the role of tacit knowledge in organisations is considered.
6.4 Organisational Tacit and Explicit Knowledge

Perhaps best known for arguing that organisations have valuable tacit knowledge are Nonaka and Takeuchi (1995). The authors identify four types of knowledge conversion in organisations:

i. Tacit to Explicit (articulation)
For example, common knowledge circulating tacitly and gradually articulated into explicit knowledge.

ii. Explicit to Explicit (combination)
For example, formal organisational information systems

ii. Explicit to Tacit (internalisation)
For example, body language that conveys knowledge implicitly such as facial expressions.

iii. Tacit to Tacit (socialisation)
For example, observation, imitation and practice. The sharing of experience such as occurs in the circulation of tacit knowledge through communities of practice without the use of language.


According to Nonaka and Takeuchi the creation of organisational knowledge involves the integration of these four processes.
Nonaka and Takeuchi posit a five-phase theoretical model of organisational knowledge creation that they claim includes the transfer of tacit knowledge. In the first phase there is a sharing of “tacit knowledge” across a range of individuals, such as may occur when members from various functional departments of an organisation are brought together to reach a common objective. There is an intense interaction between tacit and explicit knowledge in the second phase. Nonaka and Takeuchi argue that a shared tacit mental model is formed and made as explicit as possible through dialogue involving deduction, induction and abduction (metaphors and analogies). Hence new concepts are formed. The third phase involves a process of justification, or screening, both consciously and unconsciously by individuals. The organisation necessarily has to make the justification explicit in some way, such as through quantitative criteria (cost, profit margin) and qualitative criteria (judgement, wisdom). According to Nonaka and Takeuchi the new concept is converted into “something tangible or concrete” (Nonaka and Takeuchi, 1995, p. 87) such as a new product or new operating procedures. The fifth phase involves the new concept moving into a new cycle of knowledge creation, intra-organisationally and inter-organisationally, that is indicative of the continuous nature of knowledge creation (Nonaka and Takeuchi, 1995, pp. 85 - 89). Nonaka and Takeuchi argue that their theory of knowledge creation relies on the transfer of knowledge concepts together with “enabling conditions”. The conditions deemed as enabling include organisational intention, autonomy for individuals as far as circumstances
permit, fluctuation and creative chaos that stimulates interaction between an organisation and its environment, information that goes beyond the immediate operational requirements of organisation members, and, finally, internal variety that reflects the environment in which the organisation operates (Nonaka and Takeuchi, 1995, pp. 74 - 83).

Baumard (1999) largely agrees with Nonaka and Takeuchi because in his view organisation members create knowledge rather than simply process data (Baumard, 1999, p. 7). He argues that people in organisations draw on tacit and explicit knowledge from the internal and external environment, physically and socioculturally, in the conduct of organisational activity (Baumard, 1999, p. 8). Initially Baumard provides an account of knowledge and knowledge creation in organisations. He then reports on case studies of organisations responding to different types of uncertainty. Subsequently, he identifies common characteristics that applied to the organisational responses and the important role of tacit knowledge.

Baumard posits that tacit knowledge has a fundamental role in maintaining organisational flexibility. The knowledge organisational members have about each other, and how they behave towards each other, results from sociocultural experience. Therefore, Baumard argues that the subjective and personal nature of tacit knowledge is an important component in managing organisations. He describes the non-communicability of tacit knowledge and
the difficulty in apprehending it. He further suggests that investigations of expertise have demonstrated the essential role tacit knowledge, a sense of intuition, has in important decision-making processes. Baumard therefore suggests that organisations make sense of their environment by the interaction of explicit and tacit knowledge (Baumard, 1999, pp. 22 - 23).

Drawing on the four types of knowledge conversion described by Nonaka and Takeuchi (1995) above, Baumard argues that organisational learning is characterised by articulation (tacit to explicit knowledge) and internalisation (explicit to tacit knowledge). However, he notes that the conversion of tacit knowledge into explicit knowledge appears to have been neglected in theories of organisational learning (Baumard, 1999, pp. 27 - 31). Baumard extends the Nonaka and Takeuchi (1995) explanation of knowledge transition to include the range of theoretical positions that are associated with individual and organisational knowledge. In the organisational sense, for example, community of practice and collective mind may be categorised as “internalisation” (explicit knowledge transferred to tacit knowledge), or institutionalised rules may be categorised as “articulation” (tacit knowledge transferred to explicit knowledge).

Baumard illustrates the diversity of terminology in the organisational literature to describe the concepts of individual explicit and tacit knowledge, and collective explicit and tacit knowledge. For example, individual tacit
knowledge is variously referred to as procedural knowledge, incidental learning, perceptual filters, automatic knowledge, encoding without awareness, learning without awareness of what is being learned, practical knowledge, behaving mindlessly, knowing more than we are willing to tell and phantasmagoric knowledge. With regard to collective tacit knowledge, it has been variously embodied in community of practice, common sense, traditions with unknown origins, web of complicities and sociology of secrecy (Baumard, 1999, pp. 29 - 31). Also, there are a range of attempts in the literature to draw together, or explain the dynamics of, the interactions between individual and collective in terms of tacit and explicit knowledge. For example, Nonaka and Takeuchi (1995), above, have provided their explanation of how all four areas may interact.

While recognising the importance of explicit knowledge, Baumard argues that the role of tacit knowledge in organisations and management is generally overlooked. In his view, many organisation contexts involve tacit knowledge such as the accepted ways of behaving, how reputations are acquired, and the power structures (as distinct from the organisation structure chart) that exist. Most of the tacit knowledge is acquired through socialisation rather than text books and theories, and it is generally regarded as the exploitable. Baumard distinguishes between intentional and automatic (unconscious) tacit knowledge and learning processes. In the former case, he suggests that this is a kind of “conjectural wisdom” with a tacit foundation (what is learned from
experience). In the latter case, Baumard argues that this is evidenced in "procedural knowledge" that guides actions and problem-solving without conscious awareness. It is through practice that patterns of behaviour can become spontaneous and in management terms, Baumard posits that the recognition of patterns might be what would allow managers to "automatically take appropriate action in a given situation" (Baumard, 1999, pp. 59 - 63).

Baumard identifies common individually-based blocks to eliciting tacit knowledge, such as individual fear of others or authority. In addition, he notes collective blocks can also inhibit acquisition, such as a collective threat to exclude an organisational member for non-adherence to a social code. In this context, Baumard describes common "provocative" strategies that have been adopted to extract tacit knowledge (Baumard, 1999, pp. 78 - 91). For example, it could be considered that Argyris and Schön's (1996) interventionist approach to organisational learning, as described in Chapter Two, attempts to extract tacit knowledge (theories-in-use) through facilitated group discussions.

Following analysis of four organisational case studies of organisations (companies concerned with mining, publishing, air transport and banking) facing various types of uncertainty, Baumard identified five common characteristics:
i. The resolution of the ambiguous situation was inscribed within a community of practice.

ii. Actors developed an attitude which called for tacit complicity.

iii. Actors elaborated an informal matrix of relationships with each other.

iv. Actors employed repertoires of actions which were commonly used within the organisation.

iv. Actors referred to and relied upon local collective knowledge.

(Baumard, 1999, p. 200).

Baumard suggests that two main conclusions can be drawn from these findings. The first is that the mobilisation of individual tacit knowledge is an exemplary way to move out of ambiguity, and the second that “organic” organisations that are less hierarchical, with “fluid” knowledge flow can provide an environment conducive to resolving ambiguous situations. Hence, current organisational constructs that emphasise hierarchical, explicit processes in fact limit their ability to see causal links and interdependencies, and opportunities to integrate ideas and extrapolate them beyond immediate experience (Baumard, 1999, pp. 200 - 201):
Knowledge is conceived, in our Western societies, as a rigid, tangible and measurable key to fit all locks – and this brings organisations to a terrible confusion between information and knowledge, between determination and comprehension, between description and involvement.

(Baumard, 1999, p. 203).

Subsequently, Baumard argues that organisations generally stifle valuable tacit knowledge by over-regulation of processes. This is done at the expense of socialisation and collective memory, which maintain collective tacit knowledge (Baumard, 1999, pp. 203 - 209. He suggests ways of protecting communities of practice and argues that a new organisational architecture is required if tacit knowledge is to be able to form and link to organisational goals (Baumard, 1999, p. 209 - 223).

The literature has considered the role of tacit knowledge beyond single organisations by taking into account the way in which tacit knowledge may apply in partnerships and cooperative ventures between organisations. For example, Lawson and Lorenz (1999) extend the unit of analysis from individual organisations to organisations working together in their consideration of collective learning, organisational learning and tacit knowledge in regionally clustered organisations. Through several case studies of technically related regionally clustered organisations in the United States of
America and the United Kingdom. In the USA case it was determined that the success of the individual companies had resulted in part through co-operative product development between competitors, and interaction between product users (the market) and the organisations. In the UK case, established routines were regularly challenged by technical consultants to try and elicit tacitly-held skills and knowledge (Lawson and Lorenz, 1999, pp. 313 - 314). Lawson and Lorenz suggest that their investigation demonstrates that is “a dynamic interaction between informal practices and more formal arrangements” (Lawson and Lorenz, 1999, p. 314). In addition it also “serves to underline the importance of understanding those mechanisms by which shared knowledge, languages and cultures are diffused at the regionally level” and the positive effect that can result from interruptions to routines with respect to generating new ideas (Lawson and Lorenz, 1999, p. 315).

The second empirical study of how organisations may gain intangible benefits focuses on one type of organisational knowledge, namely collaborative know-how. Simonin (1997) argues that organisations develop explicit and implicit routines via know-how that is the result of corporate perceptions and alliances. In his view, collaborative experience may take the form of joint ventures, consortia, equity participation, contractual agreements, and informal co-operations (Simonin, 1997, p. 1157). Despite the difficulties inherent in devising arrangements that seek the transfer of tacit knowledge and other intangible benefits (Simonin, 1997, p. 1156), Simonin hypothesises that:

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i. Firms with higher levels of collaborative know-how will achieve higher levels of tangible benefits from a collaboration.

ii. Firms with higher levels of collaborative know-how will achieve higher levels of intangible benefits from a collaboration.

iii. Firms with greater collaborative experience will achieve higher levels of collaborative know-how

(Simonin, 1997, p. 1156 - 1158).

Using the results of a questionnaire survey, responded to by 151 top executives in large American corporations (Simonin, 1997, p. 1164), a statistical analysis brought Simonin to conclude:

i. ...that organisations do learn from past collaborations by developing skills in identifying potential collaborators, negotiating the form and specifics of collaborative agreements, managing and monitoring the arrangements, knowing when to terminate them, and transferring knowledge. This collaborative know-how in turn allows firms to achieve greater benefits from collaborations.
ii. ...previous collaborative experience does not ensure that a firm will benefit from a collaboration. That is, experience is only valuable if the lessons of this experience (both positive and negative) are internalised by the firm and drawn into specific know-how that can be used to guide future actions...

iii. ...the importance of experiential learning in developing collaborative know-how.

(Simonin, 1997, p. 1167).

By his own admission, Simonin recognises that there are limitations to the methodology he adopts (Simonin, 1997, pp. 1168 – 1169) and he concedes the need for further investigation into, for example, the link between individual and organisational experience, know-how, and learning (Simonin, 1997, p. 1170).

6.5 Organisational Explicit Knowledge

All of the above authors have illustrated that organisational learning cannot simply be conceptualised as tracking shared explicit knowledge. This is because there is a large amount of knowledge crucial to the functioning of organisations that is not easy (impossible?) to articulate and results from complex sociocultural and environmental factors. Cognitive processes of individuals and organisations incorporate tacit and explicit knowledge. In this

... there are deep controversies over what is meant by organisational knowledge, by the dynamics of knowledge, their relationship to organisational learning and the role of the wider, national context...

(Clark et al, 2000, p. 455)

They are generally critical of Nonaka and Takeuchi’s (1995) and Baumard’s (1999) contributions. For example, with respect to the former, Clark et al argue that they are “remarkably silent on the politised nature of knowledge” (Clark et al, 2000, p. 457) and with respect to the latter, they argue that Baumard:

...seems to reproduce the latent functionalism of Nonaka, while at other junctures he seems to lapse into a transcendental mysticism in relation to knowledge management...
...His celebration of tacit knowledge and his identification of it as being integral to dealing with “puzzling situations” runs the risk of championing tacitness at the expense of everything else.

(Clark et al. 2000, p. 459).

According to Clark et al. there are important problem areas that need to be addressed in the debate about tacit knowledge, including:

i. The dichotomy between exponents of explicit knowledge (knowledge management) and tacit knowledge (organisational learning) needs to be addressed because they are related domains of academic and practical work. The fusion of explicit and tacit might be expressed in terms of explicit knowledges.

ii. The recognition of the temporal dynamics of knowledges and knowing in organisations.

iii. The abundance of prescriptive accounts with too little systematic evaluation of concepts against empirical evidence. Organisational knowledge is causally defined and its relationship to knowledge in the wider context is not made clear.

iv. The lack of systematic critique of key contributions, especially of Nonaka and Takeuchi.
v. The content of knowledge is rarely examined. Firms unwittingly invest in categories and languages as expertise even though they do not know they are doing this. The emerging consensus is that knowledge is heterogeneous, contested, distributed, partly articulated, inherently complex, ruptured and suffused in asymmetrical power relations.


Clark et al’s identification of major issues concerning the role of tacit knowledge is indicative of the need for further research. It is, however, noteworthy that, similarly to the concept of implicit learning in the previous Chapter, there is no argument against the role tacit knowledge may take in the overall functioning of organisations.

In terms of the literature concerning organisational knowledge it is reasonable to suggest that there is confusion about what knowledge is. The common mistake, as noted in the previous Chapter, is to confuse knowledge with its representation, as argued by Churchland (1983) above. Notably, Nonaka and Takeuchi’s (1995) contention that tacit knowledge can be made explicit defies logic because, by definition, there is great difficulty in expressing tacit knowledge. What may pass as the expression of tacit knowledge in Nonaka and Takeuchi’s methodology does not take into account Nisbett and Wilson’s
(1977) evidence that people “tell more than [they] can know” and Polyani’s (1967) argument that people “know more than [they] can tell”. Knowledge is more accurately to be considered in terms of cognitive processes – they way people think. Unlike deliberate sentence manipulation as might be applied to explicit learning and explicit knowledge, the concepts of explicit learning and the storage of explicit knowledge attempts to take into account the experiential and practical components of knowledge. Conceptualising or modelling organisational learning therefore requires processes that extend well beyond the explicit routines of organisations because important data are lost in the coding of representations, such as, reporting quantities as distinct from reporting quality, judgement or wisdom. In spite of the practical suggestions above, in Nonaka and Takeuchi (1995), the difficulty in isolating, extracting and disseminating tacit knowledge is apparent. Polyani (1967), Nisbett and Wilson (1977), Koriat (1993) and Churchland (1983) demonstrate that people do not necessarily have conscious access to their own thoughts despite having the feeling that they do. While Nisbett and Wilson (1977) demonstrate that when individuals are asked to recall what has been the basis of their decision-making “they tell more than they can know” despite having the feeling that they do know, superimposing this situation onto a collectivity lays the framework for appreciating the often overlooked complexity involved in organisational learning.
6.6 Summary

This Chapter has argued that in the literature the concept of "knowledge" is as confused as the concept of "learning". However, the importance of tacit knowledge, particularly in organisational settings, has been demonstrated. Moreover, just as the distinction between implicit and explicit learning was found to be questionable in Chapter Five, the distinction between explicit and tacit knowledge has been found to be questionable in this Chapter.

Building on Chapters Five and Six, the next Chapter will consider, in more detail, collective learning as it has been described in the field of "situated action". This will include an analysis of the ability of connectionism to take into account both tacit knowledge and socially distributed cognition.
Chapter Seven:

Situated Action, Collective Learning and the “New” Organisation

7.1 Introduction

In Chapters Four, Five and Six it has been argued that there is much more to “learning” than that which is consciously accessible, represented in symbolic form via verbal or written word and adheres to rules. The evidence for implicit learning and tacit knowledge could be assumed to be of major interest to managers who are seeking to make the best use possible of knowledge and learning in their organisations.

Resnick (1991) argues that the cognitivist view of knowledge, the notion of symbolic/sentential representation in individual brains similar to computer software programs, has largely disappeared in favour of a constructivist understanding of knowledge. The constructivist view suggests that “most knowledge is an interpretation of experience, an interpretation based on schemas, often idiosyncratic at least in detail, that both enable and constrain individuals’ processes of sense-making” (Resnick, 1991, p. 1). In other words, what individuals know is personally constructed. However, according to Resnick, events of direct experience are only part of a more complex outlook as knowledge is also acquired, for example, via interactions involving language, writing, pictures and gestures. In her view:
...constructivism forces students of many social phenomena to treat social processes as cognition, leading them to analyse ways in which people jointly construct knowledge under particular conditions of social purpose and interaction.


Language, as previously demonstrated in Brown and Duguid’s (1996) study of photocopy technicians, appears to be such a major component of learning processes that Clark (1997) refers to language as “the ultimate artefact” because it enables people to

...reshape a variety of difficult but important tasks into formats better suited to the basic computational capacities of the human brain.

(Clark, 1997, p. 193).

This Chapter explores the role that sociocultural and environmental concerns take in knowledge creation and learning. The Chapter clearly extends the unit of analysis from the individual to collective learning by using the theories of situated action. It is demonstrated that the fragmented nature of situated action theories may be addressed by uniting them with connectionism. Connectionist
models are found to support such a view. The Chapter concludes with an analysis of the implications for organisational design and infrastructure.

7.2 Situated Action/Learning

The contributions made to understanding "situated action" arise from anthropology, cognitive psychology, developmental psychology, cultural psychology, computer science, cognitive science, education and social theory. At the core of this perspective is the opposition to the view that symbolic representations and processes occurring in individual brains provide the complete explanation for knowledge and learning. For the purposes of this thesis, the term "situated action" refers to a conglomeration of diverse theoretical perspectives that seek to focus on how human knowledge is formed by individual brains interacting with the structures of the world. However, it is not a simple concept, because:

One cannot look at just the situation, or just the environment, or just the person: To do so is to destroy the very phenomena of interest. After all, it is the mutual accommodation of people and the environment that matters, so to focus upon one aspect in isolation is to destroy the interaction, to eliminate the role of the situation upon cognition and action.

(Norman, 1993, p. 4).
Some of the other terms that fall under the umbrella of situated action are “situated cognition” (Kirshner and Whitson, 1997), “everyday cognition” (Rogoff and Lave, 1999), “socially shared cognition” (Resnick, Levine and Teasley, 1991), “distributed cognition” (Salomon, 1993) and “distributed intelligence” (Pea, 1993). In contrast to the traditional symbolic approach to cognition, situated action tends “to emphasise the importance of historical influences, social interaction, culture, and the environment, and to minimise the importance of internal cognition” (Norman, 1993, p. 4). While it is not possible to define situated action precisely, a central conceptual theme is the situated nature of learning through activity and the pragmatic considerations involved in problem solving, without overlooking the important role that symbol manipulation has in some of those cognitive activities. Hence, in situated action the context of cognitive activity may include physical objects (tools of trade), task characteristics, people involved and the social context in which the activity and learner are embedded. In this regard, Clark (1997) refers to the “embodied” and “embedded” nature of cognition (Clark, 1997, pp. 87 - 94).

The work of Lave since the 1980’s is regarded as central to the field of situated cognition (Kirshner and Whitson, 1997, p. 12; Lakomski, 1999, p. 282). It is therefore essential that her views are discussed. Lave (1991) suggests that a new understanding of learning can be achieved by exploring what occurs in “communities of practice”. Community of practice refers to the
conception of knowledge as it applies to becoming a member of a sustained community and developing a personal identity as a member of that community, thereby becoming knowledgeably skillful as part of the whole process of building a community. Hence, knowledge is regarded as more than the internalisation of knowledge by individuals and is a product of the collectivity (Lave, 1991, p. 65).

Lave refers to ethnographic studies of learning that occur in various apprenticeship models around the world in which formal teaching and assessment is not a major component. What the learner acquires is demonstrated to all concerned through the results of direct participation in the work practices rather than intentionally arranged. This means that there is an informality concerning the levels of skills acquisition progress, in that the learner’s perspective and comprehension of overall practice changes while they are learning on-the-job (Lave, 1991, pp. 68 - 69). In some respects, at least, would appear to be the likelihood of elements of implicit learning in the knowledgeably-skilled participation situations that Lave describes, as there is largely unintentional organisation in the learning activities.

As a further example, Lave describes the learning of the skill of midwifery that occurs through peripheral participation of individuals in the course of daily life without any identification of the learners as apprentices. In this situation, learning is improvised in practice alongside more experienced
individuals (Lave, 1991, p. 71). These examples serve to illustrate that knowledge and skill are an integral part of the process of becoming competent practitioners within a community of practice. As Lave (1991) argues:

It is through this process that common, shared, knowledgeable skill gets organised, although no-one specifically sets out to inculcate it uniformly into a group of learners. (Lave, 1991, p. 71).

There is a seamlessness about the way knowledge is acquired and the resulting meaning and structure attached to it. Lave concludes that successful communities of practice provide novices with broad goals in the context of an initial understanding of the whole situation; then allow the novice to improvise within a social structure of “exemplars of mature practice” and thereby facilitate the transformation of a novice to master (Lave, 1991, p. 72). Notably, there is an interdependence between novices and masters. Novices need the master in order to learn, and the master needs novices to continue the community of practice. This, according to Lave, brings into force basic tensions to the process of learning. At the crux is the collective understanding of the lived identity and changing roles (identities) of the novice and master over time, together with the identity of the community structure that develops because of the activities of the practitioners (Lave, 1991, p. 74).
With respect to the contemporary workplace, Lave argues that commoditisation of labour has largely removed the construction of personal identity from knowledgeable skill. In her view accrued skilled knowledge may simply disappear from a workplace (a community of practice) if it is not encompassed in the construction of identity associated with mastery and conditions are not in place for the devolution of the knowledge concerned (Lave, 1991, p. 76). Lave suggests that situated action, as she describes it, provides a richer account of the internalisation and transfer of knowledge than does the cognitivist account.

The alternative offered by Lave’s theory to the traditional cognitivist view of knowledge (Lave, 1991, p. 80) has as its basis her view that practice, structure and experience in interaction with each other form each other.

In so doing they constitute characteristic substantive relations among persons acting, settings, situations, systems of activity, and institutions. Such relations of articulation are culturally, historically specific; they are, arguably, key signatures of particular social formations. They include characteristic processes through which persons’ understanding in practice changes. (Lave, 1991, p. 80).
Case studies of Japanese processes to induct novices into traditional arts, mechanics, medicine and music. For example, provide a rich tapestry of the type of situated learning that is generally described in situated learning, with the strong overlay of culture (see Singleton, 1999).

Levine and Moreland (1991) define culture as the shared thoughts and customs of group members (Levine and Moreland, 1991, p. 258). From this position they analyse the types of information and forms of behaviour that constitute work groups that generally fall outside of the scope of formal job descriptions, and how such knowledge is transmitted. According to Levine and Morland there are two assumptions that are widely shared by work group researchers:

i. ...most work groups develop cultures that are helpful rather than harmful.

ii. ...such groups function best when their members view the world from a common perspective.


With respect to shared thoughts, Levine and Moreland found that groups typically sought information in three main areas. First, group members were found collectively to want to understand their group in terms of uniqueness, history and future, quality, norms and interactions with the world at large
(Levine and Moreland, 1991, pp. 258 - 260). Secondly, group member concerns centered on gaining knowledge about individual members of the group and how they are viewed and treated collectively (Levine and Moreland, 1991, pp. 261 - 262). Thirdly, collective answers were sought by group members concerning the work they do in terms of performance and working conditions (Levine and Moreland, 1991, pp. 262 - 263). Customs that form part of culture can be classified as routines, accounts, jargon, rituals, or symbols, according to Levine and Moreland (1991). Such group customs may be expressed indirectly and thus make it difficult for non-members to make correct interpretations. It follows that learning the culture of a group is a complicated undertaking because culture is often tacit and is constantly redefined by the work group members (Levine and Moreland, 1991, p. 265).

Following the recruitment of a new group member, Levine and Morland argue that there is a process whereby the group tries to mold the individual so they will be in a position to contribute more effectively to group objectives and goals. Concurrently with this process, the newly recruited individual attempts to change the group to suit their personal needs. At least part of this effort involves the transmission of cultural knowledge (Levine and Moreland, 1991, pp. 265 - 266). The level of acquisition of cultural knowledge possible by a new recruit is significantly influenced by their demonstrated commitment to the group, their task and social skills, together with their personal characteristics. Original, experienced group members, “masters” or
“oldtimers”. are possibly affected by all these traits in determining how much information will be shared. New recruits may resort to conforming to preconceived ideas held by experienced group members, or mimic them, in an effort to acquire group knowledge. More formal, structured means of acquisition may involve trainers or mentors (Levine and Moreland, 1991, pp. 266 - 269).

Masters in work groups, by virtue of status, have a considerable degree of control over the transmission of cultural knowledge. They may be influenced by how a group is currently performing even to the point of withholding information. To expedite a new recruit’s acquisition of group culture, Levine and Moreland (1991) argue that masters may use initiation ceremonies, maximise contact with other masters, ensure that there is consistency in training and acculturation, and periodically review an individual’s perception of group culture (Levine and Moreland, 1991, pp. 270 - 272). Despite the positive aspects of acculturation, there are also circumstances where groups may develop cultures that are less than helpful, such as when groups in dangerous working conditions suppress public expression of fear. In these circumstances, new recruits may be in a position to produce cultural change, intentionally or unintentionally, particularly if masters are prepared to listen (Levine and Moreland, 1991, pp. 272 - 273).
7.3 The Important Role of Artefacts in Knowledge Creation

Whether taking a cognitivist or constructionist point of view, it is difficult to question the important role of language in knowledge creation and experience. Orr (1996) demonstrates the critical role language plays in enabling photocopy technicians to complete their work successfully on an on-going basis. His ethnographic study (studied in some detail by Brown and Duguid, 1996, see Chapter 2) highlights the skills required of service technicians in dealing with problems encountered due to the inadequacies of documentation or the inability of clients to describe accurately the difficulty being experienced (Orr, 1996, pp. 160 - 161). Most importantly, Orr (1996) found that:

Control and understanding are achieved through a coherent account of the situation, requiring both diagnostic and narrative skills. Understanding is maintained through circulation of this knowledge by retelling the narratives to other members of the community, and this preservation of understanding contributes to the maintenance of control. Practice also depends on the technical skills necessary to do any repair, the only element of technicians’ practice commonly acknowledged to be part of the work. Technicians, however, know that control requires more than purely mechanical skills. Accordingly, when technicians
gather, their conversation is full of talk about machines. This talk shows their understanding of the world of service: in another sense, the talk creates that world and even creates the identities of the technicians themselves.


Orr’s (1996) study illustrates the notion of implicit (diagnostic skill based on experience in the event of unusual situations) and explicit learning (diagnosis based on service manuals and narrative accounts) as it applies in a work-related social context. It also supports the constructivist view of learning, that learners construct their own reality based on their perceptions of experience and the physical laws of the world, together with a socially negotiated model of knowledge that is always subject to revision based on new experiences (see Malinen, 2000, pp. 48 - 49). Clearly, no one person can know all there is to know about photocopiers. to use Orr’s (1996) example, so a culture and form of organisation develop to alleviate this biological constraint, hence extending learning and knowledge beyond individual brains.

Pea (1993) also argues against conceptions of learning as only occurring in the minds of individuals. In his view:

Knowledge is commonly socially constructed, through collaborative efforts toward shared objectives or by dialogues
and challenges brought about by differences in persons’ perspectives. Intelligence may also be distributed for use in designed artefacts as diverse as physical tools, representations such as diagrams, and computer-user interfaces to complex tasks. In these cases, intelligence is often distributed by off-loading what could be elaborate and error-prone mental reasoning processes as action constraints of either the physical or symbolic environments.

(Pea, 1993, p. 48).

The use of artefacts, Pea posits, is an important and integral part of “distributed intelligence” together with the social environment in which cognitive activity takes place. Pea suggests that “distributed intelligence” is a more appropriate term than “distributed cognition” and his emphasis is on the sociocultural domain aligned with situated action. His main contention is that the distributed nature of cognitive activity has both material and social components. Artefacts may range from a pair of scissors, x-y coordinate graphs, to the latest microprocessor calculating or word processing devices. Pea takes the view that human activity, in organisations for example, is therefore collaborative means-end adaptation to achieve shared objectives using both material and social components of distributed intelligence (Pea, 1993, pp. 49 - 50). Pea argues that artefacts or tools “literally carry intelligence in them” (Pea, 1993, p. 53) because they persist for the use of
others as a result of community practice and observations what has worked in
the past. Consequently, novices may learn how best to utilise an artefact by
imitation, self-teaching or through guidance from experienced individuals
(Pea, 1993, pp. 53 - 54). Pea extends his argument to include a consideration
of the concept of “desire” in initiating human activity because people do not
only act in routine ways. They also innovate according to their perceptions of
the resources that are available, and the interpretations of situations that they
are experiencing. Hence, Pea concludes that creative responses to situations
result from specific desires in a particular activity (Pea, 1993, pp. 54 - 56).

The augmentation of intelligence with mechanisms to support learning and
other cognitive processes is demonstrated by Pea. For example, the impact of
computer technology in terms of data collection and virtual realities allows
complex subject matter analogous to real-world phenomena to be manipulated
and interpreted by learners (Pea, 1993, pp. 58 - 60). According to Pea, guided
participation, which distributes cognitive processes across a group of peers, or
a learner-mentor system, and external “inscriptional systems” such as paper
and pen, have also made significant contributions to furthering intelligence. In
the case of inscriptional systems, he argues that terms such as “symbol
systems” or “representational systems”, the more commonly used
terminologies, have become too closely affiliated with the cognitive science
interpretation of “mental representation”. Pea argues that this deflects from
the distributed view that symbols and representations develop from
sociocultural activities, and therefore exist in the external world (Pea, 1993, pp. 58 - 61). Pea highlights the difficulties that inscriptional systems can cause to learners because they rarely convey the true nature of activities and their effectiveness is reliant on correct cultural interpretations and meaning. He argues that novices need to have been introduced to, and preferably participated in, activities that make the symbols and representations meaningful. This is because the representations are not the social practice per se (Pea, 1993, pp. 61 - 63).

Pea generally supports the work of Lave (1991) and others of the situated cognition school of thought as it has provided insight into how people can exploit physical and social situations without recourse to mental symbol manipulations unless they are specifically required. The concept of situated action falls short. Pea argues, by not acknowledging the role of design (the selection of activities and manipulation of the environment) in the activities studied (Pea, 1993, p. 63 - 64). In this regard, he analyses a conventional six-stage model of problem solving. He demonstrates that the processes involved are more accurately conceptualised as cyclical rather than lineal and that the process is the result of distributed intelligence rather than individual achievement (Pea, 1993, 65 - 70). Hence, Pea concludes that the example:

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22 It is notable however that Levine and Moreland (1991), this chapter (p. 237 - 239), indicate some progress in this regard by considering tactics that might be used by masters or novices in group culture acquisition.
...illustrates that the activity is a product not of intelligence in the individual mind, but of one’s memory, the structure of the resources available in the environment at hand, and one’s desires, which guide the interpretation of these structuring resources. Through the processes of design and invention, we load intelligence into both physical, designed artefacts and representational objects such as diagrams, models, and plans. We exploit intelligence from objects when we use them instrumentally in activities. And we often have to decouple intelligence from such objects to reuse them in novel ways.

(Pea, 1993, p. 70).

It is evident that proponents of situated action tend to downplay the role of symbolic representation in their explanations of learning and knowledge. Not surprisingly, researchers of the cognitivist tradition of learning and knowledge take exception and a significant debate is evident in the literature. The next section briefly outlines the essence of the debate described.

7.4 The Cognitivist/Situated Action Debate

In 1993, situated action as a field was criticised by Vera and Simon (1993). Arguing from a traditional cognitive science perspective, they posit that sensory stimuli from the environment are converted into symbol structures in
memory and that interaction with the environment is determined by "motor symbols" produced (Vera and Simon, 1993, p. 9). Symbolic structures may include words, mental pictures, diagrams and "other mental representations of information" (Vera and Simon, 1993, p. 10). The authors regard symbols as patterns in the way that electromagnetic patterns represent them in computers. However, they note that the form in which symbols are represented in the brain is not known other than that they are probably patterns of neuronal arrangement "of some kind" (Vera and Simon, 1993, p. 9). According to Vera and Simon, symbol patterns also denote or designate other symbols or sensory stimuli associated with motor actions. Hence, "perceptual and motor processes connect the symbol system with its environment, providing it with its semantics. the operational definitions of its symbols" (Vera and Simon, 1993, p. 9). Actions may be explained in terms of perception, thinking and motor activity that "may or may not be guided by long-term plans (or strategies that adapt to the feedback of perceptual information" (Vera and Simon, 1993, p. 10).

Vera and Simon provide examples of projects (simulation of forest fires, robotic vehicles, and sensing robots) based on traditional symbolic, though at least partially interactive, systems that, they observe, collectively demonstrate real-time, real-world complexities of interaction. With respect to the social environment, Vera and Simon are in agreement with situated action proponents and their understanding that human behaviour is socially and

According to Vera and Simon, learning can be explained:

...primarily in terms of its internal mechanisms ... taking the input (e.g. material from a textbook) as given, and seeking to model how that input changes the internal contents of memory so that the system will subsequently possess the desired skill or the desired knowledge...and extending the inquiry to explaining how just that textbook was used or produced, or how particular knowledge in the textbook came into being.

(Vera and Simon, 1993, p.43).

Vera and Simon conclude that situated action is useful in the sense of developing theories of human interactions with the environment, however, such theories can be accommodated by appropriately programmed symbol systems (Vera and Simon, 1993, p. 47).

Not all authors accept that symbol processing is explanatory of all human intelligence, for example, Greeno and Moore (1993) argue that:
The central claim of situativity theory is that cognitive activities should be understood primarily as interactions between agents and physical systems and with other people. (Greeno and Moore, 1993, p. 49).

Despite the fundamental problem of how people construct and attach meanings to symbols, symbol manipulation is more appropriately treated as a particular type of cognitive activity within the overarching concept that all cognitive activity is situated (Greeno and Moore, 1993, pp. 50 - 51). In Greeno and Moore’s account of situated action may include symbol manipulation processes but cognitive activity also includes non-symbolic processes. Most importantly, neither of the processes necessarily operates concurrently with the other as a particular cognitive activity is dependent on the situation or problem being addressed (Greeno and Moore, 1993, p. 55). Greeno and Moore go so far as to question the necessity of symbol processes as advocated in traditional cognitive science by considering the navigation and orienting processes of a robot guidance system that drives vehicles utilising a neural network for steering. The authors argue that the characterisation of the guidance system as a purely “symbol-based system” (as Vera and Simon 1993, p. 28, do) is not necessarily the whole story. Greeno and Moore suggest there is an alternative interpretation based on hypothesised neural structure changes that occur in animals orienting themselves. In Greeno and Moore’s view, navigation and orienting could be based on processes of direct
perception, together states of orienting and locomotion (Greeno and Moore, 1993, p. 56). Hence, rather than disregarding the Physical Symbol System Hypothesis altogether, Greeno and Moore suggest that the insights it has provided could be used in a synthesis with situated action theory (Greeno and Moore, 1993, pp. 57 - 58).

In Clancey's (1993) view,

All action is embodied because perception and action arise together automatically: Learning is inherently "situated" because every new activation is a part of an ongoing perception-action coordination. Situated action is not a kind of action, but the nature of animal interaction at all times, in contrast to most machines we know. This not merely a claim that context is important, but what constitutes the context, how to characterise the world, arise together with processes that are coordinating physical activity. To be perceiving the world is to be acting in it -- not in a linear input - output relation (act - observe - change) -- but dialectically, so that what I am perceiving and how I am moving codetermine each other.

(Clancey, 1993, pp. 94 - 95, italics in original source).

Clancey extends the notion of situated action by taking into account some neuropsychological aspects of cognition. He argues that symbolic systems of
representation always include and involve non-symbolic systems and demonstrates the depth and breadth of these phenomena via examples extracted from the literature:

i. Regularities develop in human behaviour without requiring awareness of the patterns, that is, without first person representations, such as grammars or strategy rules.

ii. People speak ideationally, in ways grammars indicate would be non-sensical.

iii. Both speech and writing require cycles of revision and rephrasing, rather than just outwardly expressing what has been prestated subconsciously.

iv. We experience interest, a sense of similarity, and value before we create representations to rationalise what we see and feel.

v. Emotions provide an encompassing orientation for focusing interest and resolving an impasse.

vi. Figure/ground perceptual reorganisations and action reorientation are rapid and apparently co-constructed.

vii. Linguistic concepts are grounded in perceptual resemblance and function in our activity, constrained by, but not restrictively defined by other concepts.
viii. Know-how is at first inarticulate and disrupted by reflection.

ix. Development involves stage effects, levels of representationality.

x. Remembering is aided by re-experiencing images and physical orientation.

xi. Every thought is a generalisation.

xii. Dysfunctions often involve inability to coordinate, not loss of modular, separable capabilities, or knowledge.

xiii. Immediate behaviour is adapted, not merely selected from prepared possibilities.

xiv. Modular specialisation of the brain correlates with the dialectic relation between perceptual categorisation and sequencing of behaviours.


Situated action in Clancey’s perspective aims to address and take into account these types of phenomena. The main claims of situated action, he suggests, are misunderstood due to different interpretations of what “situated” means. He argues that situated action includes:

i. Consideration of internal mechanisms of motor and sensory systems (not only the placement in the real-world contexts),
ii. seeking explanations about how representations and planning are used in already coordinated activities.

iii. seeking to explain how perception and comprehension function together, accepting that with every interaction there is learning,

iv. seeking explanations for flexibility and improvisation not captured by symbolic models, and recognition of the limitations and inflexibility of computer programs (modified extract, Clancey, 1993, pp. 92 - 93).

In Clancey’s account of situated action, symbols are not regarded in the sense that a computer program may be, rather as what is evident in an person’s behaviour and beliefs as they are articulated through, for example, speaking, commenting on the meaning of images or revising written work. Hence, symbolisations in the preceding sense, can be deliberately modified so that new conceptualisations and ways of behaving can be formed (Clancey, 1993, pp. 98 - 99). Clancey does not dispute that cognitivist-type symbols are still important, however, he posits that they require interpretation and comprehending, and possibly reinterpretation and a new comprehension in the light of new information, over a period. He argues that there is a conflation of the word “symbol” by researchers who adhere to the Physical Symbol System Hypothesis, to the point that they regard what is viewed outside a brain as the same as what is inside a brain, thereby overlooking any notion of what other
forms of representation might be capable of explaining (Clancey, 1993, 100-103).

Rather than accepting the notion of manipulating verbal/linguistic expressions according to rules as the means of finding an answer to a problem, Clancey argues that problems arise in the coordinated activity of people, how they perceive of such activity, together with their verbalised/linguistic sense of a situation. Problem solving is a more complex activity. Hence, problems, in part, arise from an inability of people "to automatically recoordinate perceptual, conceptual, and symbolic categorisations" (Clancey, 1993, p. 105). In this regard, it is possible to see that people share knowledge by:

...gesturing, orienting [their] bodies, mimicking sounds and postures, and so on, interactively in [their] behaviour. Couples [their] perception and action, providing the foundation for speaking a common language, constructing shared casual models, deliberating and planning complex activities.


Hence, Clancey does not reject symbol processing, however, he posits that it needs to be synthesised with a neuropsychological account of situated learning. Clancey's contribution to understanding situated action draws attention to the prominent role different forms of representation and social
interaction play in his explanations of knowledge and learning. However, 
Clancey’s view needs to be kept in the perspective of Vera and Simon’s 
(1993b) critique. Arguing from the base of the Physical Symbol System 
Hypothesis, they are highly critical of Clancey’s argument, and suggest that 
his contribution:

...is largely a series of categorical assertions (about what situated 
action “really is”, about what (linguistic) symbolic systems 
“cannot do” and what they “conflate”, and so on, almost entirely 
unbuttressed by empirical evidence. Such empirical claims as are 
made are of an extremely general sort. supported, at best by 
vague, whole-volume references...There are many references, to 
be sure, but they are mainly to philosophical tracts, lacking 
specific, testable empirical content.

(Vera and Simon, 1993, p. 11).

The preceding arguments presented by Vera and Simon (1993), Greeno and 
Moore (1993) and Clancey (1993) are representative of groups in debate that 
have opposing views about what constitutes knowledge and learning. Vera 
and Simon (1993) take a cognitivist position and regard knowledge and 
learning in terms of the processing and storage of symbolic representations of 
the world. Greeno and Moore (1993) and Clancey (1993) suggest that symbol 
manipulation does not provide a full account of cognitive processes. They
argue, in the constructivist sense, that there are situational and environmental elements of knowledge and learning, bellying symbolic representation, which must also be taken into account. As described in the previous Chapter, confusion exists in that many researchers equate “knowledge” with its “representation”. The practical nature of much of what people do belies symbolic representation. Knowledge is more appropriately equated with the cognitive processes of people, which incorporate the implicit/tacit and explicit elements of knowledge, and the way people think.

In his analysis of “constructivism”, of which situated action is an example, Phillips (1995) notes that confusion often arises because there are various constructivist sects, members of which adhere to one or other of the following viewpoints without necessarily being explicit about the position being adopted:

i. …cognitive contents of the minds of individual learners…

ii. …growth of the “public” subject-matter domains…

iii. …a combination of i. and ii.

(modified extract from: Phillips, 1995, pp. 5 - 6).

Phillips’ account of constructivism notes that there are a large number of authors who have contributed to the field including von Glaser, Kant, Kuhn, Piaget, and Dewey. The greatest difficulty is that each author expresses
various forms of constructivism that are complex and do not readily align with each other. Using Phillips’ example to illustrate this point:

...von Glaser [does not] simply [put] forward a view about the teaching of mathematics and science; it is clear that he is also advancing an epistemology, a psychology, and his own interpretation of the history of science and philosophy.


Phillips argues that despite the ideological aspects in some forms of constructivism, the notion that there needs to be active participation by a person in a social setting to bring about learning is to be well regarded. In his view, constructivism has also brought epistemological issues to the forefront of seeking to understand learning with positive outcomes. It appears that Phillips’ greatest concern is that constructivism tends to downplay the role that, for example, symbolic accounts of learning may take in improving “...the nature and operation of our knowledge-constructing communities...” (Phillips, 1995, pp. 11 - 12). In this regard, Clancey’s (1993) contribution to situated action stands out because he does not reject symbolic systems and he extends the argument of other researchers by attempting to take into account what does the constructing, the brain. In the following section artificial neural net models of learning and knowledge are considered to
address Vera and Simon’s (1993) criticism of Clancey (1993) in regard to the lack of empirical evidence for his line of argument.

7.5 Situated Action and Connectionism

Tacit knowledge and the dynamic nature of forms of organization, as discussed in Chapter Six, have not gone unnoticed in connectionist accounts of learning. Smolensky (1995a), for example, in his account *On the Proper Treatment of Connectionism* refers to inaccessible expert knowledge and decision-making outside of any single person (Smolensky, 1995a, pp. 35 - 36). He also refers to the context dependency of knowledge (Smolensky, 1995a, p. 60), also that knowledge can take the form of symbols and rules, and implicit patterns acquired through extensive experience (Smolensky, 1995a, p. 61). In summary he posits:

i. Macro-inference is not a process of firing a symbolic production but rather of qualitative state change in a dynamical system, such as a phase transition.

ii. Schemata are not large symbolic data structures but rather the potentially intricate shapes of harmony maxima.

iii. Categories (it turns out) are attractors in dynamical systems: states that “sink in” to a common place many nearby states, like peaks of harmony functions.
iv. Categorisation is not the execution of a symbolic algorithm but rather the continuous evolution of the dynamical system — the evolution that drives states into the attractors that maximise harmony.

v. Learning is not the construction and editing of formulae, but rather the gradual adjustment of connection strengths with experience, with the effect of slowly shifting harmony landscapes, adapting old and creating new concepts, categories and schemata.

(Smolensky, 1995a, p. 80).

The schema and concepts evoked by situated action, and explicit and tacit knowledge as it applies to organisational structure, are observed to cohere with the connectionist view of learning and knowledge. For example, Quartz (1993) demonstrates the plausibility and coherence of constructivism through the application of neural networks because they have the ability to add new connections as a function of their learning process. Hence, neural networks simultaneously have the ability to represent a logically coherent interpretation of constructivism together with being naturalistically representative (Quartz, 1993, p. 240). It is reasonable to suggest, therefore, that the conceptions of situated action and cognitivism are included into connectionist models of knowledge and learning.
The anthropological field study of ship navigation conducted by Hutchins (1996), briefly mentioned in Chapter Three, is a detailed connectionist account of organisational processes in “the real world”. Therefore, it warrants further consideration. Hutchins argues that the computational nature (in the connectionist sense) of the process by which the ship’s position is plotted (Hutchins, 1996, pp. 117 - 174) is compatible with it being distributed between different members of the ship’s crew, and stretching across their artefactual environment. He extends his view to consider the navigation team and its artefacts as a cognitive unit. The social organisation of the team functions as its cognitive architecture and the division of labour serves as a kind of modular decomposition (Hutchins, 1996, pp. 175 - 228). He concludes that:

...organised groups may have cognitive properties that differ from those of the individuals who constitute the group. These differences arise from both the effects of interactions with technology and the effects of a social distribution of cognitive labour.

...The members of the team are able to compensate for local breakdowns by going beyond the normative procedures to make sure that the representational states propagate where and when they should.

(Hutchins, 1996, p. 228).
Connectionist computer simulations developed by Hutchins (1996) provide a framework for explaining how cognitive properties of socially distributed systems may be influenced by particular situations and factors. The simulations are extreme simplifications of the phenomena they model, however, they are providing useful empirical knowledge.

The connectionist models take into account the distribution of event schemata across members of a community, the distribution of access to environmental evidence and the distribution of predispositions (Hutchins, 1996, p. 249). This is supplemented by communication parameters, for example the pattern of interconnections among the networks in the community and the time course of communication. An important result to emerge from Hutchins’ (1996) organisational simulations is that there is a fundamental trade-off. In horizontal structures there was found to be a greater potential for indecision and an extensive variety of interpretation. Conversely, in vertically aligned structures, some interpretation was ready accepted with the consequent narrower field of interpretation (Hutchins. 1996. pp. 260 - 261). Evers (2000) suggests that Hutchins’ (1996) simulation outcomes provide fertile ground in understanding management structures. An example may be found when inappropriate management structures are thoughtlessly imposed on existing organisations, the objectives of which are stifled by the new management overlay (Evers, 2000, p. 223).
Connectionism, as described in Chapter Four, has led to a neurologically plausible understanding of how the brain is capable of concurrently manipulating symbols, such as language, and storing representations, as neuronal patterns of activation. Such a view supports the position that learning is a process of immense complexity involving conscious and unconscious aspects that cannot always be represented sententially. A connectionist view supports the notion of explicit learning that results in consciously acquired knowledge and also implicit learning that is explanatory of skilled practice acquired unconsciously. A connectionist account of learning therefore suggests that there is a need to reconsider the traditional understanding of organisations and the learning that takes place in them.

7.6 The “New” Organisation and Connectionism

Lakomski (1999) identifies organisations as examples of situated action. She argues that individual employees cannot perform all the cognitive processes required in the functioning of an organisation on their own because human beings have finite cognitive abilities, therefore:

...the contracting out of cognitive tasks, or the cognitive division of labour, has been essential in order for people to become the kinds of advanced knowers that they are by some kind of cognitive bootstrapping. It is in this sense that external structures
are extensions of the mind. This is rarely considered explicitly, and yet it is deeply imbedded in everyday life...Mind and world are indeed indivisible...

(Lakomski, 1999, p. 296).

The problem faced is that what is commonly referred to as good practice or competent practice, whether referring to individuals or collectives, belies symbolic representation and can only be demonstrated in action. Organisations are usually capable of demonstrating knowledge and learning in the explicit, cognitivist information-processing sense, and that is important. An organisation is more than a simple aggregation of individuals and an altogether different unit of analysis. Accordingly, the concepts of implicit learning and situated action suggest that there is a need to consider the role of tacit knowledge and learning in a collective, or organisational, sense. Organisational knowledge, therefore, is far more than any symbolic representation may be capable of conveying.

Spender (1998) draws on a wide range of literature, including philosophy, cognitive science, social psychology and anthropology, in an attempt to determine what constitutes organisational knowledge. He argues that the predominance of the traditional cognitivist view of organisational theory is restricting the application of a broader contemporary cognitive science perspective. The latter school of thought observes that mental representations
result from "complex selection, sorting, manipulation and conversation processes that are shaped by our existing knowledge, interests and attentions (Spender, 1998, p. 13). Spender posits that contemporary cognitive science seeks to explain how human beings construct and combine their intentions, representations, computations and behaviour. In an organisational theory sense, there is a desire to understand how organisations operate and reflect the intention of the management. The problem is the tendency, in the cognitivist tradition, to try to reduce this to certainties with underpinning rules. In addition, the adoption of simplistic learning models, according to Spender, has led to the assumption that there is one kind of knowledge, based on physical symbol manipulation, that is unaffected by the mediation of cognition and perception. Spender argues that this view is problematic, as it does not take into account the tacit knowledge, implicit and embedded in action, which results from learning by doing:

Inasmuch as organisations are dynamic patterns of social activity, rather than scientifically designed tools for the achievement of well-understood objectives, the knowledge most evident in their day-to-day activity may well be more implicit rather than explicit. Organisations may be more systems of meaning and action than rule-bound production systems. (Spender, 1998, p.15).
From this basis, Spender develops a model of organisational knowledge that is centred on the activity that occurs in organisations. He analyses the relationship between individual and collective mind. Foundational works on social cognition and collective mind suggest the possibility of a dynamic interrelationship between individuals and the collective to which they belong (Spender, 1998, pp. 15 - 20). These explorations gave particular attention to the development processes that lead to collective mind. Spender argues three significant difficulties remained: the source of knowledge was not considered, the effect of the knowledge on the collectivity was not considered, nor was the means by which a collectivity learns considered. In this regard, Spender suggests that a new organisational theory would take into account individual and collective cognition while also encompassing a theory of learning, memory and knowledge application (Spender, 1998, pp. 20 - 21).

On Spender's account, a reconsideration of the role that activity takes in the construction and reconstruction of knowledge provides the basis on which to progress the development of such a complex organisational theory. In his view, individuals move into a collective as an activity system rather than as a system of symbolic knowledge. Hence, Spender argues that collective mind is contextualised in a field of activity and embedded in practice. Put another way, Spender suggests that the content of collective mind probably results from knowledge acquired in the course of practice. Sharing the same abstract knowledge does not produce a collective mind, though it may become so if
there is discussion or some form of intellectual activity in which other kinds of understanding are developed (Spender, 1998, pp. 22 - 23). He posits that cognition is not simply learning construed as adaptation but rather it is intimately linked to the ability to think instead of just automatically responding to stimuli (Spender, 1998, pp. 28 - 29). Spender argues this is often the basis of system theory frameworks, which expound multi-level theories of learning in organisations. In his view, these theoretical approaches overlook what is being learned and how it is applied. He describes the difficulty inherent in trying to extrapolate the notion of human beings’ native consciousness to organisations because organisations are artefacts created by people. An enduring problem is how to explain the collective consciousness of an organisation (Spender, 1998, pp. 27 - 29). To address this issue, Spender overlays constructs of developmental psychology with those of organisational theory. He argues that novice learning-by-doing under the watchful eye of a master encapsulates explicit and implicit knowledge at both individual and social levels of cognition. However, the novice’s consciousness is unique, but partly socialised, and their individuality may exert pressures on the emerging collective mind or pattern of activities. This is demonstrated often in the investigations associated with situated action and concepts of communities of practice (Spender, 1998, pp. 29 - 33). Consequently, Spender concludes that there are two axiomatic concepts at the core of his analysis, a space or zone and the activity (individual and social) that occurs in that zone. In addition, “contextualised action is the principle on which we build notions of both
cognition and recognition” and the “key to cognition ...lies in the
development of consciousness”, implicit and explicit, individual and social
(Spender, 1998, p. 34).

Spender’s account of organisational knowledge is a significant contribution to
the field as it draws together many of the concepts discussed in this thesis
(cognition is not simply symbol manipulation, learning involves implicit and
explicit processes, there are social aspects to learning, collectivity cognition
exists). However, his emphasis is on what occurs in the organisation thereby
overlooking the external context of organisations, the environment in which
they exist, including other organisations.

In contrast to Spender’s view of organisations, Clark (2000) gives greater
emphasis to the environmental, societal and international, contexts in which
organisations exist. He suggests that “firms are imbedded and shaped by their
national contexts and that the contexts vary in the capabilities which inhere”
(Clark, P., 2000, p. 230). Perhaps more importantly, Clark (2000) draws a
distinction between:

...action in/of organisations which is the outcome of ongoing
struggles yet retains pre-existing mechanisms, repertoires; [and]
the transformation of those features.

(Clark, P., 2000, p. 231).
In his view, the concept of organisation routines as a means of understanding organisational knowledge is limited because organisations are in a constant state of flux within their changing environments. While the concept of routines is important, routines cannot be changed as quickly as the "momentary environments" in which organisations exist and they therefore equate to a simple cognitive view of organisations (Clark, P., 2000, pp. 94-95). Clark argues that the concept of "recurrent action patterns" is more applicable.

Recurrent action patterns contain the history-specific and firm-specific idiosyncratic elements – as frequently repeated action sequences – representing both the pace and efficiency of [an organisation]. Equally, they contain the inertial elements and habitus that sets the zone of manoeuvre for future changes in the repertoire and in the performance of [an organisation]. (Clark, P., 2000, p. 240).

He posits that features of recurrent action patterns that are compatible with routines include:

i. patterned sequences of actions that are repeated
ii. co-ordinated by communication and authority
iii. distributed among several actors
iv. in interlocked role sets
v. knowledge is tacit and unarticulated
vi. routines are situated and emergent

(Clark, P., 2000, p. 239)

Clark recognises that there is significantly more research to be done on the theory of recurrent action patterns. However, his theory provides a suggestion of a connectionist view of organisations, as it involves understanding action concerning a particular organisational event in terms of its distribution across a large number of actors (whether they are present or absent) within a particular contextual period. The overall time element may include periods of "temporal differentiation". periods of unequal or different activity, such as may be seen in the industries linked to season work. Understanding action in the above way, then, would necessarily involve taking into account tacit knowledge that actors hold and the organisational specific knowledge held as frequently repeated action sequences. Hence, recurrent action patterns are associated with procedural memory that is longer lasting and not easily expressed verbally. In Clark's view, routines are likely to slow organisational

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Boisot, 1995, provides a conceptual tool called the "Information Space or I-Space" that he claims "can be used to study the codification, abstraction, and diffusion of knowledge - i.e., its production and exchange - in a social system...[it] allows [the] study [of] how knowledge and information flow through the system and how they evolve as they do. Such flows describe a social learning process by means of which new knowledge and information can enter the system. Recurrent information flows give rise to transactional patterns which [may] crystallise into organisations...whose characteristics reflect their specific location in the I-Space. ...The resulting structures exert a reciprocal influence on the flows, and subsequently help to shape them...Culture emerges as a particular configuration of flows and structures..." (Boisot, 1995, pp. 5 - 6).
change whereas a greater awareness of current practices may enhance change processes (Clark, P., 2000, p. 241).

Clark argues that an organisation brings into play a repertoire of recurrent action patterns as a current or anticipated event might require. Hence, he suggests that organisations may be thought of as having a range of structures, defined by recurrent action patterns, which are linked to, and triggered by, internal and external situations of an organisation. The repertoire of recurrent action patterns represents the organisational memory and knowledge (Clark, P., 2000, p. 245). Clark demonstrates recurrent action patterns by considering the sugar beet industry. As the industry is dependent on the seasons, the activity of an organisation involved in the processing of sugar beet is unevenly spread in time (temporal differentiation). As future events unfold a range of recurrent action patterns, that are in some way connected to situations external (the market) and situations internal (the processing plant) to the organisation, are brought into effect. Hence, rules, routines and recurrent action patterns that are not applicable in the “down time” have to be re-established, largely by management, in time for the processing of the sugar beet to occur. Once processing is underway, senior management takes a low profile and plans for the end of the processing period, while younger management deals with the twenty-four hour, seven days per week, day-to-day running of the plant in conjunction with supervisors and senior operators. When the processing operation has finished, there is a gradual change in roles and tasks as
refurbishment and checking of the plant is undertaken. Senior management resumes a more central role and the staff begins to work normal working days and weeks. Hence, this example demonstrates the notion of recurrent action patterns, organisational repertoires and distributed activity systems that change on an annual cycle (Clark, P., 2000, pp. 241 - 245).

The basic requirements for a theory of structural repertoires and activation, according to Clark, needs to take into account the following:

i. It should conceptualise the sequential and durational aspects of recurrent action patterns. Also, theory must connect the spatial-temporal dynamics of the interlocked actions to the social mechanisms through which they are constituted and actors develop models which drive everyday action.

ii. The notion of a repertoire requires specification with respect to the scope and richness of the repertoire.

iii. Repertoires contain active and dormant patterns. How are these activated? In the case of patterns which are dormant for long periods how are they retained in the repertoire?

iv. Recurrent action patterns in the repertoire provide the basis for the reproduction of ongoing action. What are the
conditions in which these patterns collapse, are disrupted
and might be the objects of change?

(Clark, P., 2000, p. 246).

In Clark’s view, conversation has a crucial role in the achievement of organisational agendas because actors in the organisation discuss the “recipes” and rules applicable to a situation and conclude what is relevant, and then make the decisions made appear acceptable. He argues that such conversations represent “the practical structure of action and the local logic of the pre-existing rules (in an ethnomethodological sense) is untangled” (Clark, P., 2000, pp. 247 - 248).\(^{24}\)

7.7 Summary

This Chapter has developed further the transition from individual constructs of learning to that of collective learning. The Chapter has also argued how situated action in tandem with connectionism may be employed in an organisational sense to assist in explaining how tacit and explicit learning occurs in organisations. Consequently, the implications for organisational design and infrastructure are found to be profound.

The situated action account of knowing and learning fused with connectionism, together with the contemporary view of organisations

\(^{24}\) Clark’s position is largely based on Boden, (1994).
presented here, in addition to the preceding arguments in previous Chapters concerning the complexity of learning and knowledge, provides the basis for what amounts to a reconceptualisation of organisational learning in the following Chapter.
Chapter Eight:

Organisational Learning Reconceptualised and Managerial Implications

8.1 Introduction

It was found in Chapter Two and Three that there are a wide range of views on what constitutes organisational learning. There are, however, points of agreement or recurring themes evident in the literature. These are:

i. Learning is useful.

ii. Organisations (collectivities) learn.

iii. Learning occurs throughout organisations.

iv. Learning involves implicit and explicit factors.

v. Learning involves contextual (environmental, social, situational) actors.

vi. Collaboration of individuals to achieve organisational purpose is complex.

vii. Individual learning is not the same as organisational learning.

viii. Individual knowledge is not the same as organisational knowledge.
It was argued in Chapter Two and Three, that the prominent oversight in the organisational learning literature is the general lack of attention given to what learning is and how it occurs. This Chapter draws together the discussions and findings from previous Chapters to provide some initial features of a new view of organisational learning based on the currently best account of cognition. An overview of the implications of this new perspective on organisational learning for managers and management concludes this Chapter, and this thesis.

8.2 Conception of Learning and Theoretical Framework

There is a tendency in the organisational learning literature to assume what learning is rather than defend a scientifically supported model of learning. Fiol and Lyles already noted this in 1988, and the situation appears not to have progressed since then (Fiol and Lyles, 1998, p. 803). In Chapter One, it was found that researchers and authors were readily influenced by current theories of individual learning, broadly perceived as behaviourist, cognitivist, and constructivist. Hedberg (1981), in particular, demonstrates the behaviourist influence through his emphasis on stimulus-response learning. Levitt and March (1988) also manifest a behaviourist sway because of their linking of organisational learning to trial and error and observable improvement.
The behaviourist approach was found to be limited in its application as it does not take account of learning that may take place without an observable change in behaviour, such as learning a new word or language. Cognitivism developed out of recognition of the limitations of behaviourism. It took into account mental processes that may be aligned with learning, in spite of the arguments about where the mental processes take place, in the mind or in the brain. The cognitivist framework of learning is demonstrated inter alia in the research of Argyris and Schön (1996), Fiol and Lyles (1985), Huber (1996), Popper and Lipshitz (2000). The predominance of the cognitivist view of learning in the literature is not surprising because of the developments that have occurred in computer science, in particular, the programmable serial processing computer. Thus, the tendency in the positions adopted by the cognitivist organisational learning group is to emphasise the explicitness and access to the products of learning, to the point where what is learned can be readily expressed in symbolic form, such as, words and language. Researchers, such as Weick and Roberts (1996), Brown and Duguid (1996), and Cook and Yanow (1996), recognise the difficulty in representing learned skills and expertise in terms of symbolic representations and adopt a constructivist framework for organisational learning. The problem of adopting a constructivist framework is that the importance of symbolic representation in communication is downplayed.
In spite of the important role the behaviourist account of learning had in the development of theories of learning, the cognitivist and constructivist theories are found to be more useful and plausible through the evidence now available on brain functioning. The traditional cognitivist position, demonstrated by artificial intelligence, has its limitations because all learning is thought of in terms of symbols and serial processing of information. In addition to the difficulty in representing skills and expertise in terms of symbols, there is the added problem of conceiving the human brain/mind as holding long, symbol-based serial processing programs for everything that is learned. As has been argued, connectionism provides a more plausible account of how people learn, represent and store knowledge in terms of patterns of activation, based on the findings associated with the capabilities of artificial neural networks; there is empirical evidence to support the claims of connectionism.

It would seem that an integration of cognitivist and constructivist viewpoints would be an appropriate consideration in advancing the concept of organisational learning. Accordingly, the philosophical artificial intelligence/connectionism debate, as described in Chapter Four, would become more a case of seeking the relevant aspects of each of their theoretical frameworks and formulating a new theoretical framework that integrates situated action. It is appropriate to suggest “based on situated action” because the analysis of situated action in this thesis demonstrated that both cognitivists and constructionists believe they can explain the situational aspects of
learning and knowledge. It is important to recognise that both the cognitivist and constructivist theories have something to offer. A reconceptualised view of learning as an integration of cognitivist and constructivist theories would significantly assist in advancing organisational learning as a field of study and connectionism appears to provide the tools by which this could be achieved.

The emphasis in most of the empirical investigations of the organisational learning literature, described in Chapter Three, demonstrated an awareness of the need to consider cognitivist and constructivist aspects of learning. However, a tendency towards explicit outcomes, changes in behaviour and management led learning in quite concrete terms is also evident. The empirical investigations, like the behaviourist account of learning, tend to overlook the fact that observable changes may not necessarily indicate that desired learning has occurred. For example, a change in behaviour may simply equate to conformity “to keep one’s job”. The emphasis on observable events belies the evidence for implicit learning and tacit knowledge. Both of these are important in learning, however, they can not be reduced to symbols or abstract notions and are not necessarily consciously accessible in any case.

However, integrating cognitivism and constructivist accounts of learning, and taking into account implicit learning and tacit knowledge, to reconceptualise organisational learning is insufficient. Using theories of individual learning to explain organisational learning is not necessarily appropriate. Most
researchers agree that individual learning is different from learning by organisations. The learning entity in organisational learning is considered in the next section.

8.3 Learning Entity of Reconceptualised Organisational Learning

While the organisational learning literature generally is in agreement that organisational learning is not simply the sum of the learning parts, the learning entity in organisational learning has been variously assumed to be either individuals, the overall organisation, or a combination of both. For example, Argyris and Schön (1996) and Hedberg (1981) quite clearly articulate that the learning entity are the individual members of an organisation. In contrast, Levitt and March (1988), Weick and Roberts (1996), Cook and Yanow (1996) and Popper and Lipshitz (2000) attribute organisational learning to the organisation as an entity in itself. Huber’s (1996) view is found in his belief that organisational learning results from learning in various entities in an organisation, such as, individuals, groups, or sub-units. It is evident that a coherent concept of organisational learning is unlikely to be achieved with such a variation in views.

Situated action draws attention to the influence that environmental factors such as artefacts and shared understanding of socially constructed knowledge, explicit and tacit, may have on learning. Situated action also supports the
notion of an important dynamic between the individual and the organisation, which can lead to a collective or organisational knowledge beyond what is held in individual heads, the notion of distributed cognition. While explicit organisational knowledge is evident in the formal policies and procedures of a organisation, it is evident that the implicit learning and the tacit knowledge within an organisation, “the way we do things around here”, is crucial in the functioning of an organisation. It thus seems reasonable to conclude that the learning entity in organisational learning is the organisation itself, without overlooking the important role that individuals take in that process.

8.4 Content and Processes of Reconceptualised Organisational Learning

As would be expected, the content and processes of organisational learning described in the literature is largely influenced by the theoretical framework of learning assumed by the respective authors as described above. Authors who adopt a behaviourist position, such as Hedberg (1981) and Levitt and March (1988), view the content and processes of organisational learning as being explicit (observable) and resulting in observable improvements.

In contrast, the authors who adopt a cognitivist position, for example, Argyris and Schön (1996), Fiol and Lyles (1985), Huber (1996) and Popper and Lipshitz (2000) equate the contents of organisational learning as explicit knowledge that is shared and recorded symbolically within an organisation.
through reports and language for example. In terms of processes, the emphasis tends to be on hypothetico-deductive constructs of learning that are descriptive accounts rather than empirically supported. For instance, in the interventionist approach posited by Argyris and Schön (1996), while their theory-in-use captures the essence of “knowing more than can be told”, there is a reliance on employees having conscious access to “what they know” and on their ability to formulate it into symbolic accounts to make it accessible to others. Empirical investigations into implicit learning and tacit knowledge have shown that there is learning and knowledge that can not be readily articulated in symbolic form. An added difficulty is that there is further empirical evidence that demonstrates that despite “feelings-of-knowing” something, people have an inability to report accurately on their cognitive process. The difficulty evident in Argyris and Schön’s techniques for extracting organisational knowledge is that the empirical evidence suggests that when people do articulate “what they know” it is passed through mind-filters such as causal theories or judgements about the plausibility of their response (Nisbett and Wilson, 1977). The inability to articulate what a person knows goes beyond any deliberate defensive action that may be taken to avoid embarrassment.

Authors who adopt the constructivist framework for learning, Weick and Roberts (1996), Browa and Duguid (1996), and Cook and Yanow (1996), view the content of organisational learning as skills and expertise.
Accordingly, the process of organisational learning in the constructivist view is less tangible than is found in the cognitivist view. Thus, the constructivist account of organisational learning consists in the transference of skills and expertise through a community of practice/organisation. There is a notion of a collective mind, or understanding, of what the organisation exists for. Most importantly, there is a concept of implicit learning, tacit knowledge and learning by doing. While there is empirical evidence that supports implicit learning, learning from experience and tacit knowledge, what is most needed is a way of conceptualising learning from experience that can be effectively utilised. Connectionism may provide such a tool.

A reconceptualisation of organisational learning recognises that there are explicit and implicit elements to learning, also that there is explicit and tacit knowledge. A reconceptualisation of organisational learning also recognises that organisational learning occurs whether or not there is intervention, top-down management led programs or other pre-planned activities. Formalised attempts at producing organisational learning may have consequences that were not intended, as demonstrated in the empirical investigations of organisational learning (see Huzzard, 2000 and Carmona and Grönland, 1998, summarised in Chapter Three).

It may be concluded that the contents of organisational learning is a complex amalgam of explicit and tacit knowledge (explicit knowledge) constructed by
individuals and a collectivity. Further, it may be concluded that the process of organisational learning is a complex combination of explicit and implicit learning (explicit learning), also involving individuals and a collectivity.

8.5 A New Understanding of Organisational Learning

It is clear that organisational learning is enormously complex. The tendency to explain learning by relatively simple cognitivist theoretical constructs has lead to the exclusion of vital elements of learning such as implicit learning and tacit knowledge. The same could be said for concepts of organisational learning. In the preceding sections it was noted that a new view of organisational learning needs to take into account the following:

i. The integration of cognitivist and constructivist theoretical accounts of learning and the best available evidence that integrates the two accounts.

ii. The dynamic between individual and organisation.

iii. That organisations as entities (collectivities) can learn and organisational knowledge is different and separate to individual knowledge.

iv. Individuals and organisations may learn explicitly and implicitly in a social context and thereby generate explicit and tacit knowledge, whether intentionally or not.
iv. Individual and organisational learning is influenced by environmental factors, such as artefacts and a shared social construction of knowledge.

It is now possible to provide a new concept of organisational learning:

Organisational learning occurs by, and is the result of, a complex dynamic involving individual and collective explicit and implicit learning of all organisational members who participate in a community-of-practice, with all of the preceding being influenced by organisational internal and external environmental factors, with the ultimate formation of collective, explicit and tacit organisational knowledge.

The new conception of organisational learning provided above integrates cognitivist and constructivist viewpoints and takes into account the currently best explanation of learning and knowledge. Unlike conceptions, definitions tend to oversimplify and create artificial boundaries when applied to complex and dynamic ideas (see p. 74, this thesis).

It follows that the reconceptualisation of organisational learning proposed here has implications for managers and the concept of management overall. Such a reconceptualisation has the potential to revolutionise the way that
managers are trained and educated, together with how structures of organisations may be perceived and modified. This is briefly argued in the next section.

8.6 Implications for Managers and Management

There are many implications of a new view of organisational learning, which cannot be discussed here. As the focus of this thesis is on learning, it seems important to consider two pertinent issues: 1. how managers learn and 2. how managers could manage in organisations to foster desirable organisational learning.

In 1988, Isenberg analysed how managers think, and made a number of suggestions on how managers could improve their thinking:

i. Bolster intuition with rational thinking. Recognise that good intuition requires hard work, study, periods of concentrated thought, and rehearsal.

ii. Offset tendencies to be rational by stressing the importance of values and preferences, of using imagination, and of acting with an incomplete picture of the situation.
iii. Develop skills at mapping an unfamiliar territory by, for example, generalising from facts and testing generalities by collecting more data.

iv. Pay attention to the simple rules of thumb – heuristics – that you have developed over the years. These can help you bypass many levels of painstaking analysis.

v. Do not be afraid to act in the absence of complete understanding, but then cherish the feelings of surprise that you will necessarily experience.

vi. Spend time understanding what the problem or issue is.

vii. Look for the connections among the many diverse problems and issues facing you to see their underlying relationships with each other. By working on one problem you can make progress on others.

viii. Finally, recognise that your abilities to think are critical assets that you need to manage and develop in the same way that you manage other business assets.

(Isenberg, 1988, pp. 538 - 539).

In essence, Isenberg alludes to the necessity for experiential learning, expertise and skills that, according to Dreyfus and Dreyfus (1986), had largely disappeared from American management in favour of quantitative methods and formula based principles. Dreyfus and Dreyfus attribute the predominance
of such principles to artificial learning models of learning (Dreyfus and Dreyfus, 1986, pp. 158 – 163). They describe the limitations of mathematical models of learning in favour of “mind-over-machine” approaches to decision-making (Dreyfus and Dreyfus, 1986, pp. 170 – 192). By their analysis:

Experienced intuitive managers do not attempt to understand familiar problems and opportunities in purely analytic terms using calculative rationality, but realise that detached deliberation about the validity of intuitions will improve decision-making. Common as it is, little has been written about that conscious deliberative buttressing of non-conscious intuitive understanding, probably because detached deliberation is often incorrectly seen as an alternative to intuition.

(Dreyfus and Dreyfus, 1986, pp. 163 - 164).

Dreyfus and Dreyfus (1986) subsequently argue the case for management learning that encompasses sequential, situational case studies and a period of apprenticeship similar to the residency period of a doctor (Dreyfus and Dreyfus, 1986, pp. 167 - 170).

Given the intuitive and expert view of management described by Dreyfus and Dreyfus, it is noteworthy that managers apparently cannot articulate clearly what it is that they do. Clark (2000) observes that the investigation of
managerial work is problematic because so many different perspectives are present in the literature (Clark, 2000, pp. 306 - 309). For the purposes of argument, Mintzberg (1989) posits that managers describe what they do as "plan, organise, coordinate and control" (Mintzberg, 1989, p. 9). In his view this does not provide any enlightenment on what managers actually do. Accordingly, he conducted research into the activities of managers. His findings were:

Considering the facts about managerial work, we can see that the manager's job is enormously complicated and difficult. The manager is overburdened with obligations; yet he or she can not easily delegate his or her tasks. As a result, he or she is driven to overwork and is forced to do many tasks superficially. Brevity, fragmentation, and oral communication characterise the work. Yet these are the very characteristics of managerial work that have impeded scientific attempts to improve it. As a result, management scientists have concentrated their efforts on the specialised functions of the organisation, where they could easily analyse the procedures and quantify the relevant information. (Mintzberg, 1989, pp. 14 - 15).

Mintzberg subsequently categorised roles that are attributed to managers, including formal and status roles, interpersonal roles, informational roles and
decisional roles (Mintzberg, 1989, p. 16). In his view, a manager’s effectiveness is significantly influenced by their insight into their own work (Mintzberg, 1989, p. 22). Beckett (1999) suggests that Mintzberg’s account allows a conclusion to be drawn that:

...whilst at work, managers can learn powerfully through experiences which are intense, dynamic, uncertain, and decisional...where decisions are taken on the run, case by case, and with the nagging doubt that action might be inadequate – superficial, hasty and inappropriate.

(Beckett, 1999, p. 84).

In view of situated action theory, Mintzberg’s and Beckett’s account of managerial practice need to be considered in terms of organisational environmental constructs and artefacts.

Despite the formal training and education available to managers, it is apparent that managers themselves have to learn in the same way as other organisation members, by implicit and explicit means. It is important, then, that managers are aware of contemporary views of what constitutes learning, as has been argued here. They need to be more aware of tacit knowledge and the implicit aspects of learning that apply to themselves and those they manage. Managers also need to recognise that the provision of formal learning activities that
generate a change in behaviour do not necessarily correspond to organisational learning for all of the reasons described above. It is a reasonable assumption that managers who understand how they learn themselves, and also how collectivities learn, will be in a position to utilise organisational learning more effectively.

It is noticeable in the literature that topics relating to the points raised by Dreyfus and Dreyfus (1986) are gaining some prominence. For example, Conger and Xin (2000) have researched the “gradual but radical transformation” of current executive education programs, and concluded that they are “far more innovative, learner centred and relevant to immediate company needs…” (Conger and Xin, 2000, p. 73). However, they give examples of the need for further changes (Conger and Xin, 2000, pp. 89 - 99). Burgoyne and Reynolds (1997) present a series of papers that seek to integrate management learning theory and practice, Garrick (1998) considers the notion of informal learning that occurs in workplaces. Boud and Garrick. (1999) consider the context, perspectives and issues of practice in understanding learning at work, and Raelin (2000) also considers the notion of work-based learning including, generally, many of the aspects raised in this thesis concerning learning.

In addition to the arguments for experiential and work-based learning that are gaining support, it is proposed here that the formal elements of the training of
managers may include curriculum that explores the way people learn, including themselves, using the best current account of cognitive processes. This notion could be extended to the notion of “manager as learner and manager as teacher”. As this thesis has argued, a connectionist approach seems most appropriate as it gives the currently most comprehensive account of learning. Managers with a significant understanding of the generation and storage of knowledge in the human brain well beyond the cognitivist view will most likely adopt a different approach to their management style. For example, consider how managers may go about their business differently if they have an understanding of employees’ inability to articulate accurately all of their knowledge, and that some knowledge may only exist in the collectivity. Such a view places a perspective on “downsizing” and “rightsizing” of organisations that would recognise the possible loss of knowledge to the overall detriment of the organisation. It also supports the view that “bottom-up” management may facilitate the finding of answers to difficult management/organisational problems hitherto suppressed. It may also transpire that managers develop a view of organisations as a whole in which an understanding emerges of a “net” of dynamic knowledge and learning processes that connects all individuals right across an organisation at all levels.

When it comes to fostering desirable organisational learning, the implications are significant. There is a need to challenge the top-down management
structure of organisations. This is because in a new view of organisational learning there is a recognition of the important role that implicit learning and tacit knowledge take in any organisation. The notion of distributed cognition and situated action puts to rest the idea of an “all knowing” manager at the top of the hierarchy. Accordingly, both the practice of management and the structures in which management takes place are areas for research if organisational learning is to be optimised.

8.7 Conclusion

This thesis has argued that variations concerning the concept of organisational learning have largely resulted from the inattention given to learning in the associated literatures. It has proposed that cognitive science, in particular connectionism, provides a basis for a more comprehensive model of learning that encompasses implicit and explicit elements of learning and knowledge, that integrates cognitivist and constructivist learning theory. In this way, this thesis outlines a direction for an integrated theory of learning. Further, it has been argued that an integrated theory of learning, together with the theory of situated action, provides a theoretical framework for a new theory of organisational learning.

This thesis has concentrated on the scientific evidence of research into brain functioning. The accumulated results of the human genome project may yet
suggest the need for collective genetic considerations as they apply to collectivities and organisations. This is because genes have their effect in correlation with the environment, such as a stressful work environment, which can be controlled to some extent. In the naturalistic tradition, it is necessary to be open to such possibilities as new scientific evidence develops. When considering learning and organisational learning, complexity is to be expected, as any process that involves human beings is inherently complex.

For example, see Jacob (1997) for a philosophical account of naturalisation of intentionality and causality that includes an individual’s mental states, ontogenic development and properties instantiated in their environment. For a preliminary, eclectic construct of the neuro-genetic roots of organisational behaviour see Silverman (2000) and Sternberg and Grigorenko (2001) offer a collection of papers concerned with the development and maintenance of cognitive abilities in correlation with genetic/heredity and environmental factors, including work environments.
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