Non-formal learning and tacit knowledge in professional work

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Background. This paper explores the conceptual and methodological problems arising from several empirical investigations of professional education and learning in the workplace.

Aims. 1. To clarify the multiple meanings accorded to terms such as 'non-formal learning', 'implicit learning' and 'tacit knowledge', their theoretical assumptions and the range of phenomena to which they refer. 2. To discuss their implications for professional practice.

Method. A largely theoretical analysis of issues and phenomena arising from empirical investigations.

Analysis. The author's typology of non-formal learning distinguishes between implicit learning, reactive on-the-spot learning and deliberative learning. The significance of the last is commonly overemphasised. The problematic nature of tacit knowledge is discussed with respect to both detecting it and representing it. Three types of tacit knowledge are discussed: tacit understanding of people and situations, routinised actions and the tacit rules that underpin intuitive decision-making. They come together when professional performance involves sequences of routinised action punctuated by rapid intuitive decisions based on tacit understanding of the situation. Four types of process are involved – reading the situation, making decisions, overt activity and metacognition – and three modes of cognition – intuitive, analytic and deliberative. The balance between these modes depends on time, experience and complexity. Where rapid action dominates, periods of deliberation are needed to maintain critical control. Finally the role of both formal and informal social knowledge is discussed; and it is argued that situated learning often leads not to local conformity but to greater individual variation as people's careers take them through a series of different contexts. This abstract necessarily simplifies a more complex analysis in the paper itself.

My interest in professional work has led me to use two parallel definitions of knowledge. *Codified knowledge*, also referred to as public knowledge or propositional

knowledge, is (1) subject to quality control by editors, peer review and debate and (2) given status by incorporation into educational programmes, examinations and courses. It includes propositions about skilled behaviour, but not skills or 'knowing how'. *Personal knowledge* is defined as the cognitive resource which a person brings to a situation that enables them to think and perform. This incorporates codified knowledge in its personalised form, together with procedural knowledge and process knowledge, experiential knowledge and impressions in episodic memory. Skills are part of this knowledge, thus allowing representations of competence, capability or expertise in which the use of skills and propositional knowledge are closely integrated. Codified knowledge is identified by its source and epistemological status, personal knowledge by the context and manner of its use. Codified knowledge is explicit by definition. Personal knowledge may be either explicit or tacit, and it is the tacit form of personal knowledge which is the main concern of this article.

What also needs to be emphasised, however, is that the process by which codified knowledge is acquired is affected by the learning context, so that subsequent use of that knowledge in a different context will require further learning. Hence the personal, available for use, version of a public concept or idea will be determined by the personal history of its use. This may have been within a single context or across a range of contexts, and will have involved its integration with other knowledge, both personal and public. Awareness of this potentially rich knowledge is rarely complete; so personal versions of even public propositional knowledge may have a tacit dimension.

Learning is defined as the process whereby knowledge is acquired. It also occurs when existing knowledge is used in a new context or in new combinations: since this also involves the creation of new personal knowledge, the transfer process remains within this definition of learning.

Informal learning is often treated as a residual category to describe any kind of learning which does not take place within, or follow from, a formally organised learning programme or event. However, for those of us who believe that most human learning does not occur in formal contexts, the utility of such a catch-all label is not very great. Moreover the term 'informal' is associated with so many other features of a situation – dress, discourse, behaviour, diminution of social differences, etc. – that its colloquial application as a descriptor of learning contexts may have little to do with learning per se. To avoid such confusion, we prefer to use the term 'non-formal learning' as the contrast to formal learning, and to make further distinctions within that heading.

We start with a broad definition of *formal learning*, which treats any one of the following characteristics of a learning situation as putting it into the formal domain:

- a prescribed learning framework
- an organised learning event or package
- the presence of a designated teacher or trainer
- the award of a qualification or credit
- the external specification of outcomes

In making this distinction, however, we wish to avoid giving formal learning a negative connotation. There are many modes of formal learning and many contexts for which at

least some of those modes are appropriate. The outcomes of formal learning are not confined to propositional knowledge; and propositional knowledge is a common outcome from many episodes of non-formal learning.

Part 1 of this paper is devoted to a general exploration of the phenomena of non-formal learning and tacit knowledge. First a typology of non-formal learning is proposed which incorporates implicit learning that gives rise to tacit knowledge, as well as reactive learning which is near-spontaneous and unplanned, and deliberative learning for which time is set aside. The nature and significance of implicit learning and tacit knowledge are then discussed. This leads to two recurrent issues: the extent to which tacit knowledge can be made explicit and the extent to which it can be identified by researchers.

Part 2 then discusses the significance of tacit knowledge for professional work and the factors affecting the use of different modes of cognition during professional work. The importance of tacit as well as explicit understanding of people and situations is established; so also is the need for routines which enable professional work to be performed without explicit thinking about all its aspects. The tacit and experiential nature of professional work is contrasted with the preferred public image of research-based practice, but without denigrating the latter or neglecting the need to keep less explicit aspects of professional work under critical control.

Part 3 is a rather briefer discussion of the respective roles of individual and social learning, which uses the conclusions of Part 1 and Part 2 to critique some recent theories of social cognition, and returns to the issue of making tacit knowledge explicit.

1: Non-formal learning and tacit knowledge

One purpose of this paper is to explore the range of learning modes within the domain of *non-formal learning*, for which a simple typology is proposed. For us the most fundamental distinction is the level of intention to learn. At one extreme there is the now widely recognised phenomenon of implicit learning, at the other there is *deliberative learning* in time specifically set aside for that purpose. Reber (1993) defined *implicit learning* as 'the acquisition of knowledge independently of conscious attempts to learn and in the absence of explicit knowledge about what was learned': there is no intention to learn and no awareness of learning at the time it takes place. We have found it useful to introduce one further category between implicit learning and deliberative learning to describe situations where the learning is explicit but takes place almost spontaneously in response to recent, current or imminent situations without any time being specifically set aside for it. This *reactive learning* is near-spontaneous and unplanned, the learner is aware of it but the level of intentionality will vary and often be debatable. Its articulation in explicit form could also be difficult without setting aside time for more reflection and thus becoming deliberative.

The other dimension of non-formal learning which we have found useful in mapping the domain concerns the timing of the events providing the focus for the learning. Are they events from the past, something happening in the present or part of some possible future action? Combining the dimensions *time of local event* and *level of intention* enables us to construct a simple typology of non-formal learning (Figure 1).

Figure 1. A typology of non-formal learning

Time of Stimulus	Implicit Learning	Reactive Learning	Deliberative Learning
Past Episode(s)	Implicit linkage of past memories with current experience	Brief *near-spontaneous reflection* on past episodes, communications, events, experiences	*Review* of past actions, communications, events, experiences. More systematic reflection
Current Experience	A selection from experience enters the memory	*Incidental* noting of facts, opinions, impressions, ideas *Recognition of* learning opportunities	*Engagement* in decision-making, problem-solving, planned informal learning
Future Behaviour	Unconscious effects of previous experiences	Being prepared for *emergent* learning opportunities	*Planned* learning goals *Planned* learning opportunities

Planned non-formal learning is clearly deliberative, but so also is the learning that forms an integral part of deliberative activities such as decision-making, planning and problem-solving. *Emergent* is the term used by Megginson (1996) to describe an alternative strategy to planning; but using an emergent strategy for defining goals need not prevent a deliberative rather than reactive approach when learning opportunities occur. Gear *et al.*'s (1995) study illustrates this point; because, although they base their enquiry on Tough's (1971) concept of a *learning* project (an extended piece of learning with a particular idea in mind), less than 20% of their respondents claimed to have unequivocally followed a pre-determined plan. *Eighty per cent* had an idea of the outcome they wanted, but followed an *emergent strategy* which took advantage of learning opportunities as they arose: the intent and the learning activity were deliberative, but the recognition of learning opportunities was reactive.

Implicit learning and tacit knowledge
The effects of implicit learning on future behaviour are well documented by Berry (1997), Reber (1993) and Underwood (1996); but these effects could not have occurred unless some selection of lived experience had previously entered long-term memory, albeit not as part of a conscious, deliberate process. The reference to linkage with past memories is there because the effects can only be explained as resulting from the accumulated experience of several episodes rather than that of a single event. But there is no conscious awareness of the memories of these episodes having been combined to form a tacit knowledge base which enables future action.

Horvath *et al.* (1996) explain both *implicit learning* and *tacit knowledge*, the outcome of such learning, in terms of Tulving's (1972) theory of memory. This distinguishes between *episodic memory* for specific, personally experienced events and *semantic memory* for generalised knowledge that transcends particular episodes. Researchers

have been particularly interested in the traffic between the two. Thus Holland, Holyoak, Nisbett, and Thagard (1986) suggest that 'the transition from event knowledge to generalised knowledge involves mental processes that are sensitive to the covariance structure of the environment, to "what goes with what" in the world' (Horvath *et al.*, p.7). These processes of induction or abstraction isolate shared features and/or structures across episodes and 'construct abstract or general representations of that shared structure' (p.7). The examples they quote suggest that they associate semantic memory primarily with propositional forms of generalised knowledge.

Figure 2. Memory structures and knowledge-acquisition pathways in the explanatory model of tacit knowledge (modified from Horvath *et al.*, 1996)
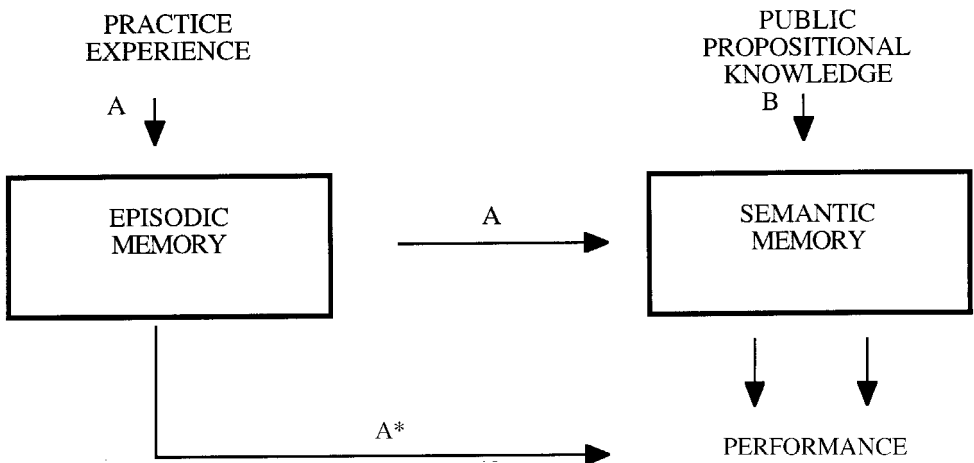

Figure 2 presents a diagrammatic representation of this theory. The top of the figure represents the sources of inputs to the memory system and the bottom of the figure represents the behavioural consequences of learning (the output of the memory system); the arrow between the boxes depicts the processes whereby generalised knowledge is derived from episodic memory. Thus Path A in the diagram corresponds to what Kolb's (1984) defines as *experiential learning*, whereby 'personally experienced events are stored in episodic memory and, over time, used to construct generalised knowledge structures in semantic memory' (p.8). Path B depicts the direct acquisition of generalisable knowledge from other people. Path A* depicts *implicit learning*, described by Horvath *et al.* as 'the direct influence of event knowledge in episodic memory on behaviour – influence that is not mediated by the generalised knowledge representations in semantic memory' (p. 8). The existence of tacit knowledge acquired by Path A* is inferred from the nature of the observed behaviour.

In practice, multiple pathways are likely to be in use. The same episodes may contribute to performance both implicitly via Path A* and explicitly via Path A. For example, an encounter with a new situation fairly similar to some of those previously experienced may lead to rapid recognition via Path A* and generation of a previously

used decision option (also via Path A*), possibly with an awareness that the match between the two situations might not be good enough for a repeat to be the best action. Explicit checking out of the option may then follow using generalised knowledge created by Path A. Another possibility is that knowledge acquired by both Path A and Path B is combined. Path B knowledge is often useful in reflection upon and clarifying the meaning of experienced events or in fitting new Path A knowledge into a broader conceptual structure (an important aim of formal mid-career courses). Conversely Path A knowledge (and probably also Path A* knowledge) is helpful, perhaps essential, for learning how to use Path B knowledge in practical situations. Typically, tacit Path A* knowledge is ready to use while Path B knowledge is too abstract to be used without considerable further learning. So if a situation demands rapid action or is too complex to be fully analysed, tacit knowledge is the only available solution. We return to these issues later in this paper, but it is important from the outset to recognise that tacit knowledge is not a sideshow but central to important, everyday action.

Like non-formal learning, *tacit knowledge* is a widely distributed phenomenon which has acquired a wide range of meanings. On the one hand Polanyi (1967) defined it as 'that which we know but cannot tell', while on the other a whole string of authors talk about making tacit knowledge explicit: this can mean either that the knower learns to tell or that the researcher tells and then seeks respondent verification. There are two aspects of this problem, awareness and representation. A person may be socialised into the norms of an organisation without being aware either of the learning or of what some of the norms are. Besides being an example of implicit learning, it is possible to imagine many types of event which might trigger awareness of these norms, for example transgressions by a third party might cause negative responses which then need to be explained. Sometimes, there is no problem in the 'telling' once awareness has been established: implicit learning may eventually lead to explicit knowledge. However, the opposite can also be true, explicit learning can lead to tacit knowledge. For example, a person may be very aware of being able to ride a bicycle and able to describe how they learned to do it, without being able to describe critical aspects of the knowledge gained, such as rapid responses to a sense of impending imbalance, while other relevant knowledge, such as the steadying effect of the gyroscopic motion of the wheels, would almost certainly never be acquired. No doubt a physicist could compile a video of someone finally achieving competence and provide a commentary, but it would be difficult to claim that this represented the knowledge of the average cyclist.

Given the awareness that one possesses certain knowledge, there are many possible forms of partial description of what some people call tacit knowledge, ranging from a glimpse, through an insight or perspective to what many might regard as a reasonable, though not complete, representation of the whole. One major difficulty is presented by the medium, another by the genre(s) in which 'acceptable' descriptions have to be communicated. For example, when researchers talk about making tacit knowledge explicit they often imply that this means presenting it as a set of propositions, like the findings from a piece of research. Moreover, most authors using the term tacit knowledge tend to treat it as a catch-all category, without seeking to define it any further. Does it refer to knowledge which is *not* communicated, or knowledge which *cannot be* communicated? Is it an attribute of the knower which some can communicate and some cannot; or is it an attribute of the knowledge itself? Could it be an element of

both? Researchers are acutely aware that some people 'tell more' than others who perform at a similar level of competence; there is also evidence that some kinds of knowledge are easier to communicate than others. Can a skilful researcher communicate what their respondents cannot; and does that suggest that the researcher is a good novelist, a potential poet or an expert in knowledge elicitation?

Spender (1995) focuses on epistemological status rather than communicability, suggesting that tacit knowledge be defined as 'that which has not yet been abstracted from practice', thus linking it to Path A* in Figure 2. But Molander (1992) argues that there is no knowledge which is totally tacit and none without at least some tacit aspect. The problem for researchers is to reach as far as they can down the continuum from explicit to tacit knowledge. In either case, there are two possible approaches to knowledge elicitation; to facilitate the 'telling' or to elucidate sufficient information to infer the nature of the knowledge being discussed. Both methods require the researcher to construct an account, and it is good practice to submit this account to respondents for verification or modification. The other conclusion to be drawn from Molander's argument is the warning that even the most complete, explicit account of expertise from an ideal witness will still lack aspects of tacit knowledge which remain unrecalled and undisclosed.

The problems faced by researchers investigating non-formal learning are very considerable. Not only is implicit learning difficult to detect without prolonged obser-vation, but reactive learning and some deliberative learning are unlikely to be consciously recalled unless there was an unusually dramatic outcome. Worse still, potential respondents are unaccustomed to talking about learning and may find it difficult to respond to a request to do so. If they do, they are more likely to refer to formal learning rather than non-formal learning. The latter is just part of their work: solving a problem at work is unlikely to be interpreted as a learning process unless an interviewer can home in on it in a particularly appropriate way. Moreover, during our own study of the *Development of knowledge and skills in employment* (Eraut, Alderton, Cole, & Senker, 1998) we were acutely aware of the difficulty of getting respondents not only to describe their job when many aspects of it were likely to be taken for granted but also to progress from that description to discuss the nature of the competence and expertise which enabled them to do that job. They were aware that they had learned implicitly to do many things which formed part of their job, but they could not easily describe their personal knowledge and know-how. The interesting theoretical question, which also has many practical consequences, is whether this knowledge was capable of being elicited by the right questions and opportunities for respondents to think about those questions, or whether it was indeed tacit knowledge which they were not able to talk to us about.

This problem has been further explored by Fessey's (1999) research which combined an ethnographic study of nurses in a surgical ward with knowledge elicitation inter-views aided by heuristic knowledge maps and digital photographs within an hour of observed events.

Our own interview-based research on learning in the workplace (Eraut *et al.*, 1998) found that the capability to tell was linked to people's prior experiences of talking about what they knew; and that talking more explicitly about their knowledge at work was more likely to occur when there was:

- some mediating object like a picture or a drawing which colleagues were accustomed to discussing, e.g., an x-ray image, a video, a diagrammatic representation of a piece of equipment, a graph or a set of figures; or
- a climate of regular mutual consultation encouraging those consulted to describe what they know; or
- a training or mentoring relationship in which explanations were expected, sometimes of cultural or behavioural norms as well as more technical matters; or
- an informal relationship leading to work-related discussions of information out of hours, when more 'provisional' and 'riskier' comments might be made which conveyed some meaning but were not understood as pretending to be comprehensive or accurate; or
- a crisis, review or radical change in practice, which caused people to exchange opinions and experiences, sometimes also to making values more explicit.

Another factor was the role of continuing education in the form of courses of serious reading. For many respondents this added an important dimension to their ability to think and talk about their work situation when it provided (1) a vocabulary for talking about aspects of their experiences which had been previously difficult to discuss and (2) concepts and theories which helped them to make sense of their experience and understand issues and alternative perspectives more clearly.

However, there is also the possibility that language used in the workplace may serve purposes other than making knowledge or actions explicit. Learning to talk to clients or colleagues or managers may be at best a semi-conscious process, during which the latent functions of the discourse are not revealed and may even remain hidden from the qualified professional participants. For example, the manifest function of discourse could be to consult and inform clients, to keep colleagues aware of your actions and to render account of your actions to managers. The latent functions may be to keep clients happy while asserting the professional role, to maintain good relations with colleagues while preserving freedom from their influence, and to tell managers what they want to hear while keeping them off your back. To serve the manifest function will often require congruence between what is said and what is done; but this may constrain the latent function. Where discourse in some professional settings has evolved to serve such latent purposes, its use in other settings may impede rather than enhance understanding of practice. In general, discourse in many settings helps (1) to provide a defensible account rather than a description of professionals' actions and (2) to create an impression of professional control over situations which inspires confidence in them as persons. It may seek to disguise rather than to share uncertainty and risk-taking. Technical vocabulary, labelling of clients or their problems, and in some cases the use of numerical data, help to achieve these purposes. It is now common practice for researchers to recognise that explicit accounts do not provide 'the whole truth', but it is relatively rare outside the overtly political domain to suggest that they may mislead because implicitly acquired discourse has developed for that very purpose.

Another approach which can aid the communication of knowledge depends on researchers being able to suggest types of knowledge which might be in use in a particular situation and to get the respondent to confirm, modify or deny their

suggestions. This requires that researchers have a repertoire of types of knowledge and knowledge use, can get sufficient understanding of their respondent's situation, and can develop ideas from that repertoire in a manner that is both appropriate to the situation and meaningful to their respondent. They also have to be able to develop relationships which empower their respondents to be brutally honest about what they think of the researcher's suggestions, and to give them the opportunity for a second, more considered response. Our own view is that both more situationally located styles of interviewing and researcher-initiated suggestions need to be pursued, but modestly and reflexively, with the underpinning awareness that there will always be multiple representations of the knowledge embedded in any complex situation.

2: The use of tacit knowledge in professional work

Tacit knowledge of people and contexts
The next two sections of this paper further explore the range of contexts in which tacit knowledge is likely to be found. The first is primarily about tacit understanding, the second is about tacit knowledge in action. One of the most important features of any workplace or community context is the people with whom one interacts – colleagues, friends, customers, clients, acquaintances. Yet much knowledge of other people is tacit: although one might gossip about them, one does not often have to put knowledge of people into words unless it is a specific part of one's job, and one might find it difficult to do so. Yet such knowledge provides the basis of unhesitating daily interactions with others. Indeed it appears to fit the Horvath *et al.* (1996) model quite well. Knowledge of another person is mainly gathered from a series of encounters set up for other purposes: only a small percentage of meetings will have getting to know that person as an objective, most often it is an incidental side effect. Yet in order to respond, one has to assume some knowledge of the person one is talking with; and this will be based on accumulated knowledge from previous encounters which one neither makes explicit nor questions. Such knowledge is unlikely, therefore, to be under one's critical control. One may also have explicit knowledge of that person created through reflection or gathered from other sources, but it is unlikely to replace the tacit knowledge which enables one instantly to respond to people one knows. Such knowledge is part of one's taken-for-granted understanding of that person, and is liable to be both biased and self-confirming.

Reasons for tacit knowledge of other people being biased include:

1) our series of encounters with another person are unlikely to provide a typical sample of his or her behaviour: the reasons and circumstances for the meetings will largely determine the nature of those encounters, and our own presence is also likely to affect what happens;

2) we are most likely to remember events within those encounters that demand our attention, i.e., those that are most 'memorable' rather than those which are most common;

3) preconceptions, created by earlier encounters, affect both parties' behaviour on later occasions, so the sample is not constructed from genuinely independent events;

4)   people develop personal constructs (Kelly, 1955), or ways of construing their environment, as a result of their life experiences; and these affect their under-standing of, and hence behaviour towards, those whom they meet.

Thus people are predisposed to interpret other people's actions in particular ways, creating preconceptions at early encounters which determine their own behaviour, and thus affect how others respond to them in ways which will often tend to confirm those preconceptions. While tacit knowledge of other people will continue to play an important part in our lives because it is available for almost instant use whenever we need it, it will rarely be as valid and unbiased as we like to assume. Greater self-awareness and remedial action will often be required (Eraut, 1994).

Knowledge of contexts and organisations is often acquired through a process of socialisation through observation, induction and increasing participation rather than formal inquiry. Thus norms, local discourse and other aspects of an organisational or occupational culture are acquired over a significant period of time by processes which implicitly add meaning to what are explicitly interpreted as routine activities. For example, Tomlinson (1999) points out that as a result of many years of schooling, student teachers implicitly 'know what teachers do'. Even though they may explicitly argue, and have personally experienced, that many teaching activities do not promote learning, this may be over-ridden by their implicit knowledge of the expected role of teachers when they are confronted by a combination of the practical need to take charge of a classroom and the psychological need to be identified as a genuine teacher and not just a student. Implicit knowledge can be very powerful indeed even when, as in most teacher training, explicit knowledge is available by the bucketful.

Another feature of a person's understanding of people and organisations is what are commonly referred to as *implicit theories*, inferred correlations or causal linkages between attributes of a person or an organisation. These theories are called implicit, because they are seldom explicitly stated by the knower but used by psychologists to explain his or her behaviour. Those observed behave as if they believed the implicit theory imputed to them. The psychological explanation for the lack of explicitness is that such theories form part of the taken-for-granted world of the knower, their social reality. The validity of this approach is confirmed both by the logic of the observations and by the recognition, albeit delayed, of implicit theories by their knowers in situations where there is no strong reason for them wishing to deny them. Horvath *et al.*'s (1996) paper quotes examples of such implicit theories, whose position in their model (Figure 2) is unclear. Path A is described as 'constructing generalised knowledge structures in semantic memory', i.e., a process by which tacit knowledge is made explicit, yet implicit theories appear to be a form of tacit knowledge stored in semantic memory in propositional form. Compared with other forms of tacit knowledge they can be readily made explicit by researchers and confirmed by their informants; but by remaining tacit they escape the influence of other, more explicit, public theories, acquired by Path B. The knowledge privacy of the implicit theorist provides protection from criticism.

Argyris and Schön (1974) provided another perspective on implicit theories when they made their classic distinction between espoused theories and theories in use. Their *theories in use* closely match the examples given by Horvath *et al.*, being experientially developed and very close to being made explicit. But the contrast with *espoused*

theories which provide explicit explanations of their actions introduces yet another dimension to our discussion. According to Argyris and Schön the central problem for most managers and professionals is that they are intellectually and emotionally committed to espoused theories which describe the world as they would like it to be, but which do not accurately describe their own actions. The result is that they do not understand, indeed do not even perceive the effects of their own actions. They tend to perceive (and in the case of managers be told by their subordinates) what they want or expect to perceive, thus receiving self-confirmation of their actions. This results in misperceiving 'what goes with what' and developing false experiential theories of action. The problem can only be solved, according to Argyris and Schön, by stepping outside their taken-for-granted world and espoused theories to search for genuine feedback on the outcomes of their actions: they called this double loop learning to distinguish it from self-confirmatory single loop learning.

Eraut (1994) has argued that the mismatch between espoused theories and theories in use is a natural consequence of the prevailing dualistic approach to professional education. Espoused theories are developed in education contexts and their comprehension rewarded by the assessment system: they also represent the way professions like to see themselves and present themselves to the public. Theories in use are developed quite separately to cope with the exigencies of practice and even if explicit would not 'be deemed fit for public communication' as they would diminish the image of the profession. Apart from preserving the often mourned but rarely narrowed theory/practice gap in many professions, espoused theories provide professionals with a 'professional conscience' which urges them to judge their work according to a form of idealised practice which is unachievable. Over time this leads either to scepticism or to frustration and burnout; the third route is to become professional educators and perpetuate the cycle. The domain of explicit and implicit theories of action is complex and little understood but also highly significant.

Tacit knowledge in action
Action is describe as *routinised* when actors no longer need to think about what they are doing because they have done it so many times before. Routinisation starts by following other people, or manuals or checklists or even self-devised procedures: these may be simple sequences with only one pathway or algorithm whose pathways diverge as one proceeds. Learning by repetition enables the actor first to reach the stage where the aid of a person or checklist is no longer required and then to progress to a future stage where an internalised explicit description of the procedure also becomes redundant and eventually falls into disuse. Routinisation can apply not only to simple procedures like changing gear when driving a car but also to complex skills like reading. Even the most fluent readers, however, maybe momentarily halted by an unfamiliar word or a clumsy clause structure. In effect, reading complex material involves implicit routinised behaviour punctuated by short bursts of explicit attention to the words themselves rather than the meaning they convey. This is typical of skilled behaviour, though sometimes the interruption comes from the context rather than the task itself. One of the most frequently cited examples of tacit knowledge, riding a bicycle, becomes far from routine when surrounded by heavy traffic. In addition to the basic routine of riding along and keeping one's balance there is a succession of reflex actions and rapid

decisions caused by the traffic; and there may also be some more deliberative thinking about the route to take, especially if the avoidance of traffic is a possible option. The picture is not dissimilar to that portrayed by Jackson (1971) when he suggested that a primary school teacher makes a thousand decisions a day.

We have now identified two apparently opposite processes: experiential learning, if we follow the Kolb model, involves deriving explicit knowledge through reflection on experiences which might otherwise remain in episodic memory and be used only tacitly; and routinisation, whereby explicit procedural knowledge is converted to tacit knowledge through repetition. But neither can be found in their pure form. Routines are regularly interrupted by short periods of problem-solving to resolve difficulties or decision-making to adapt to changes in the external context. Experience cannot be represented only by abstract propositions. While Horvath *et al.* (1996) infer from their interviews of military commanders a set of 'tacit knowledge' propositions about leadership, they state that it would be pointless to try and teach these propositions to trainees who lack the requisite experience, but they do not explain their reasons. My own view is that they have impaled themselves on a proposition-based definition of tacit knowledge. However, these propositions, like other maxims, do not represent the full range of knowledge in use; they may be little more than aides memoires. Most of the tacit knowledge lies in recognising the situation as one in which the maxim is appropriate – what Klein (1989) calls 'recognition-primed decision making'. Although such maxims may not have played any part in previous actions, making them explicit may help to draw attention to the context and conditions where it is appropriate to use them; and that is when the 'real' tacit knowledge begins to be disclosed and further learning is more likely to occur.

We are now ready to examine what most people would regard as the bastion of explicit knowledge use and the polar opposite of tacit knowledge, classical *decision theory*. This involves constructing mathematical models of decision-making situations so that calculation can be used to determine the relative merits of different options. These models are not dealing with certainties – they rarely occur – but with probabilities. Since there is good evidence that naturalistic judgment gets complex situations involving combinations of probabilities badly wrong, the approach is not without its use. Moreover, it can also take into account the respective values which people attach to different options. To be useful, however, there must be (1) a sufficiently good match between the model and the decision-making situation being modelled and (2) sufficiently good 'probability for outcome' data and 'utility' data (utility is the technical term for the value attached to a particular outcome).

This theory gave rise to applications in business and medicine as well as the continuing development of economics. A pioneering book by Weinstein and Fineberg (1980) led to the approach we now call *evidence-based medicine*. This incorporates both a research and policy strand and a practitioners strand. The research strand emphasises meta-analyses of research studies with priority being accorded to those involving randomised double blind control trials. Current British policy is focused on using both research and expert meetings to compile practice guidelines which are graded at three levels:

(1)   those based on control trials alone

(2)   those based on a wider selection of research evidence
(3)   those based on agreements by experts in areas where there is insufficient research evidence for level 1 or 2 reports.

There is also a fourth type of situation, where the amount of evidence and expert agreement is too small to be able to produce any defensible set of guidelines. This attempt to map the corpus of explicit medical knowledge is bringing out both the strengths and limitations of what Schön (1983) calls the technical-rationality paradigm. In some areas the focus on research is saving many lives, in others the production of research-based guidelines is a distant aspiration. While the government rightly seeks to expand the research base into areas of greater complexity and uncertainty, not more than 20% of medical decisions are currently covered by existing or planned level 1 guidelines. This figure has been elicited from interviews with several people working in this area. Outside this 20% responsibility reverts from national guidelines to less reliable guidelines or the unguided decisions of the individual practitioner or health care team.

How then, we ask, are individual and/or team decisions made in the absence of research-based guidelines and what is the role in such decisions of tacit knowledge? Eraut (1999) has approached this issue by distinguishing between three modes of cognition – analytic, intuitive and deliberative – and discussing the factors which affect their relative importance in different situations. The analytic mode has two ideal types, evidence-based practice and theory-based argument. From a practitioner viewpoint evidence-based practice is not confined to following policy guidelines where they exist; it incorporates a general attitude toward evidence, and it seeks both to maximise the amount of evidence from systematic observation and recording and to interpret it more critically than is currently the norm (McMaster EBMWG, 1992). The McMaster group specifically warned that:

> In the absence of systematic observation one must be cautious in the interpretation of information derived from clinical experience and intuition, for it may at times be misleading.

But they also argue that 'clinicians must be ready to accept and live with uncertainty and to acknowledge that management decisions are often made in the face of relative ignorance of their true impact'.

There is a danger that the continuing discovery of the importance of tacit knowledge will lead some people to argue on ideological grounds that it should replace evidence-based practice. My own view is the opposite, that we should seek to expand evidence-based practice but not suffer from any delusions about how far it will take us nor lose awareness of just how much interpretation of guidelines may be needed when making decisions about individual cases.

The difficulty of interpretation is even greater when we consider the other analytic ideal type – the use of theory. Even in well-theorised areas of practice, the interpretation of theory is problematic and requires further learning from experience. So for practitioners additional knowledge is required beyond the set of propositions taught as

theory and the evidence suggests that this additional knowledge is highly situated and very often tacit (Eraut, 1999).

The intuitive mode of cognition relies more on prior experience than theory or research, and makes considerable use of tacit knowledge. Even when that knowledge is capable of being explicitly described by the actor, it may be used tacitly because that is usually quicker. The various aspects of the intuitive mode are conveniently introduced through the Skill Acquisition Model of Dreyfus and Dreyfus (1986) which brings together situational understanding, routinised action and decision-making. They describe their model, which was originally developed to counter what they considered to be the over-ambitious claims of decision analysis, as an integrative overarching

Figure 3. Summary of Dreyfus model of skill acquisition

Level 1	*Novice*
	Rigid adherence to taught rules or plans
	Little situational perception
	No discretionary judgment
Level 2	*Advanced Beginner*
	Guidelines for action based on attributes or aspects (aspects are global characteristics of situations recognisable only after some prior experience)
	Situational perception still limited
	All attributes and aspects are treated separately and given equal importance
Level 3	*Competent*
	Coping with crowdedness
	Now sees actions at least partially in terms of longer-term goals
	Conscious deliberate planning
	Standardised and routinised procedures
Level 4	*Proficient*
	See situations holistically rather than in terms of aspects
	See what is most important in a situation
	Perceives deviations from the normal pattern
	Decision-making less laboured
	Uses maxims for guidance, whose meaning varies according to the situation
Level 5	*Expert*
	No longer relies on rules, guidelines or maxims
	Intuitive grasp of situations based on deep tacit understanding
	Analytic approaches used only in novel situations, when problems occur or when justifying conclusions
	Vision of what is possible

approach to professional action. Their model, presented in Figure 3, depicts progression through five levels from Novice to Expert.

Its early and middle stages involve the development of situational recognition and understanding and of standard routines which enable one to cope with crowded busy contexts; the later abandonment of explicit rules and guidelines as behaviour becomes more automatic; and a peaking of the deliberative mode of cognition (not usually very analytic) at the competence stage. Progression beyond competence is then associated with the gradual replacement of deliberation by more intuitive forms of cognition.

Tacit knowledge appears in their model in three different forms; as tacit understanding, tacit procedures and tacit rules:

- *Situational understanding* is being developed through all five stages, based largely on experience and remaining mainly tacit,
- *Standard, routinised procedures* are developed through to the competence stage for coping with the demands of work without suffering from information overload. Some of them are likely to have begun as explicit procedural knowledge then become automised and increasingly tacit through repetition, with concomitant increases in speed and productivity,
- Increasingly *intuitive decision-making*, in which not only pattern recognition but also rapid responses to developing situations are based on the tacit application of tacit rules. These rules may or may not be explicit or capable of reasoned justification, but their distinctive feature is that of being tacit at the moment of use.

Both Dreyfus and Dreyfus (1986) and Benner (1984) cite evidence to support the widespread use of rapid intuitive decision-making by experts, but do not establish their claim that deliberation has become virtually redundant. Benner recognises two situations where analytic approaches might be required: when an expert is confronted with a situation of which she has no previous experience or when the expert gets a wrong grasp of a situation then finds that events and behaviours are not occurring as expected. Dreyfus and Dreyfus suggest yet a third possibility, that 'detached deliberation about the validity of decisions will improve decision-making' (p. 164). Roughly translated, their advice is that if an intuitively derived proposal for action does not feel right, or has an equally compelling alternative, think carefully about its likely effects.

'Not feeling right' is an example of *implicit monitoring*, a meta-cognitive process which may trigger either immediate action or reflection followed by rapid action. The latter would correspond to what Schön (1983) calls 'reflection-in-action', though Eraut (1995) points out that Schön's use of this term is inconsistent and its epistemological status uncertain.

The deliberative mode of cognition was first identified by Aristotle but is still difficult to define. Practitioners will usually be in deliberative mode when they are planning, evaluating, problem-solving or reflecting on their experience. Some group discussions might be classed as group deliberations, and individual deliberations could often be described as discussions with oneself. Deliberation is similar to the intuitive mode in making considerable use of personal experience and similar to the analytic mode in being a mainly explicit process. Two purposes for deliberation can be usefully distinguished, although they are sometimes combined in practice: *reflective deliberation* has been discussed in considerable depth by Dewey (1933), its purpose being to make sense of and/or evaluate one's experience, including what one has heard and read; *prospective deliberation*, however, is directed towards a future course of action and includes decision-making and resolving contentious issues.

It is difficult to decide the extent to which deliberation is a distinctive mode of cognition, a mixture of analysis and intuition, or a hybrid of the two. Intuitive incidents

occur at many stages of a deliberative process: retrieval from memory, recognition of a pattern, the sudden emergence of a new idea, the sense that a particular course of action will work. Periods of analysis will also occur during deliberative periods which offer sufficient time; but the problems and issues are usually too complex and too uncertain to be handled in a purely analytic mode. The argument for treating deliberation as a distinct mode is that for much of the time the thinking is neither intuitive nor analytic. It may involve turning things over in one's mind, looking at the situation from different angles; trying to make sense of many viewpoints, many sources of information and many theoretical perspectives; searching for ways to frame the problem; trying to reconcile conflicting factors; developing a new approach; or exploring possible scenarios. Another confusing feature is the status accorded to the finished product of thinking rather than the process of achieving it. The distinctive genre of the scientific paper or scientific book demonstrates what Kaplan (1964) called reconstructed logic rather than an account of their creation. This paper may appear to be an analysis of the phenomena of implicit learning and tacit knowledge, but its production involved a great deal of deliberation.

Eraut (1994) suggests that typical features of deliberative processes are:

- some uncertainty about outcomes;
- guidance from theory which is only partially helpful;
- relevant but often insufficient contextual knowledge;
- pressure on the time available for deliberation;
- a strong tendency to follow accustomed patterns of thinking; and
- an opportunity, perhaps a requirement to consult or involve other people.

These processes cannot be accomplished by using procedural knowledge alone or following a manual. They require a unique combination of propositional knowledge, situational knowledge, professional experience and judgment. The tendency to use familiar schemata is crucial for quick action in relatively familiar situations, but can be a major handicap when the situation is radically different – an important argument for involving other people.

What factors are likely to affect the mode of cognition employed by a particular practitioner in a particular context? An analytic approach depends on there being sufficient research evidence available in which the practitioner has confidence, the problem being capable of being represented in a form which enables it to be 'solved' mainly on the basis of that evidence, and the practitioner being willing and able to do the analysis and implement the results. An intuitive approach requires that the practitioner has considerable experience of similar situations. A deliberative approach works best when the practitioner has both some evidence and some relevant experience, a willingness to reflect and consult and a sense of what is possible under the circumstances. What is at issue is not the use of evidence, as Hammersley (1997) points out, but 'the relative importance of different kinds of evidence'.

However, evidence, complexity and the practitioner's capability and disposition are not the only factors affecting mode of cognition. Two very important variables derive from the context rather than the agent or the task. These are the time available and the

Figure 4. Interactions between time, mode of cognition and type of thought/action

Thought/Action	Mode of Cognition		
	Instant/Reflex	Rapid/Intuitive	Deliberative/ Analytic
Reading of the situation	Pattern recognition	Rapid interpretation	Review involving discussions and/or analysis
Decision-making	Instant response	Intuitive	Deliberative with some analysis or discussion
Overt activity	Routinised action	Routines punctuated by rapid decisions	Planned actions with periodic progress reviews
Metacognitive processes	Situational awareness	Implicit monitoring Short, reactive reflections	Conscious monitoring of thought and activity Self-management Evaluation

crowdedness of the situation, i.e., the number of clients, activities, pieces of informa-tion, etc. competing for the practitioner's attention. Figure 4 depicts the effects of time on mode of cognition. This relationship is probably interactive: shortage of time forces people to adopt a more intuitive approach, while the intuitive routines developed by experience enable people to do things more quickly. Crowded contexts also force people to be more selective with their attention and to process their incoming information more rapidly. Under conditions of rapid interpretation and decision-making, meta-processes are limited to implicit monitoring and short, reactive reflections. But as more time becomes available, the role of meta-processes becomes more complex, expanding beyond self-awareness and monitoring to include the fram-ing of problems, thinking about the deliberative process itself and how it is being handled, searching for relevant knowledge, introducing value considerations, etc.

Our earlier example of riding a bicycle in traffic involves the simultaneous operation of two or more modes of cognition. Maintaining balance and steering are fully automated activities, while responding to traffic movements may entail both reflex responses to sudden events and rapid intuitive responses to anticipatory readings of a developing complication. When the traffic is relatively calm, it would not be unusual to engage in deliberative thinking about one's route or actions to be taken after reaching one's destination. Such multiple mode operation is particularly evident in teamwork. In 'hot action' teams like a surgical team, a group of musicians or a football team, mutual dependence is high and close coordination essential. Mutual awareness and reflex responses maintain coordination, while momentary lapses are potentially remediable by rapid decisions which restore synchrony. Experienced performers have both a developed sense of what it feels like to be working in perfect harmony and the capacity developed through long practice in a particular team to reach that ideal state. In addition, there would usually have been deliberative planning and decision-making prior to performance as well as practice in working together. In 'cool action' teams

engaged in a project, a deliberative mode is the established normal state; but when people interact in a more animated way, sparking each other off or arguing, rapid responses are likely to occur which lead to new insights. Participation in discussion often involves deliberative thinking about the topic, rapid comprehension of what others are saying, and rapid decision-making about when to speak and what kind of contribution to make. In every case there appears to be more than one mental process in action: some make considerable use of explicit knowledge, while others rely mainly on tacit knowledge. Moreover, although the processes are distinguishable from each other, they also interact in ways we rarely comprehend.

Individual knowledge or social knowledge?
Having defined 'personal knowledge' as the cognitive resources which a person brings to a situation which enables them to think and perform, it is important to ask to what extent such knowledge is really personal? There are two strong arguments against regarding knowledge as solely individual in nature. The first comes from evidence that in some situations people are unable to perform on their own: individual knowledge is necessary but not sufficient. The most obvious example is the 'hot action' teams we described in the previous section. Another is when activities are sustained in an organisation by many different people who do not form a team and do not necessarily act together. These activities usually persist despite changes of personnel, so can the knowledge that sustains them be regarded as purely personal? *Distributed cognition* is the term used to describe such phenomena; though its use has been most commonly applied to people working with computers whose programmed knowledge contributes to their performance. It is argued that the performance of a person interacting with a computer is dependent not only on the knowledge of the individual but also on that of those who designed the programme and indeed the computer itself. This theme is well developed from a number of perspectives in the book edited by Salomon(1993).

The second argument against conceiving knowledge as solely individual is an extension of the concept of *situated learning*. We have been arguing throughout this paper that knowledge is shaped by the context(s) in which it is acquired and used. Learning is always situated in a particular context which comprises not only a location and a set of activities in which knowledge either contributes or is embedded but also a set of social relations which give rise to those activities. This raises the important question of the extent to which any given piece of knowledge is individually or socially constructed within that context. One increasingly popular theoretical response is to define cognition as that which enables social processes to take place and cannot therefore reside in the head of any one individual. This is congruent with the concept of distributive cognition but depersonalises cognition even further. Salomon's own contribution to his book (1993) argues cogently for a reciprocal relationship between individuals' cognitions and distributed cognitions, citing in particular the role played by individuals' representations.

My own argument starts from a simple typology suggested by Spender (1998) (Figure 5), which recognises both individual and social modes of cognition and maps them against the explicit-implicit distinction which has dominated much of this paper.

At the beginning of this paper we defined 'formal learning' in terms of characteristics of the learning situation. But how does this map onto real situations? If we consider the

Figure 5. Individual and social modes of cognition

	Individual	*Social*
Explicit	Conscious	Objectified Scientific
Implicit	Automatic Intuitive	Collective Cultural

archetypal context for formal learning, the school, we find good evidence of many types of learning occurring (or sometimes not occurring) simultaneously. Explicitly stated curriculum knowledge, with which formal learning is usually identified, is only one aspect of the process. Pupils are also learning how to present work for assessment; how to participate in shared discussions; algorithms and schemas for reading and problem-solving; a hidden curriculum of orderly, disciplined behaviour, working to deadlines and submission to authority; and a rich array of knowledge, beliefs, attitudes and behaviour from peer group interaction. Can these separately listed forms of learning be separated from each other in practice? It is hard to imagine a formal learning context in which only explicit learning of explicit knowledge takes place. To focus only on the explicit learning of formally presented knowledge is to fail to recognise the complexity of learning even in well-ordered classrooms. The knowledge gained is constructed in a social context whose influence on what is learned, as well as how it is learned, cannot be denied.

Where then is the evidence for individual cognition, if explicit knowledge and implicit knowledge are both socially constructed and socially mediated? Even in formal settings, research has shown huge individual differences, both quantitative and qual-itative, within communal learning arrangements. Some can be attributed to observed differences in classroom transactions involving individuals: individual students receive differentiated treatment from their teachers and their peers, learn to respond to different people in different ways, and accumulate different episodes in their long-term memory. Other differences in outcomes can be attributed to the differences in prior knowledge and disposition with which they enter their school or college. Individuals do not enter a given setting with identical cognitive resources, the setting rarely treats them in a completely uniform way, and their experience is therefore somewhat differentiated. The time spent in that setting is an important variable, and access to knowledge will depend on a person's level of participation.

A significant feature of a very traditional society is a limited number of lifetime pathways through a limited number of social settings, with consequent constraints on access to knowledge and the size of the potentially available knowledge base. In a post-Fordist modern society, however, there is a very large range of social settings, a greater variety of people within those settings and a huge number of pathways through successive settings. Thus, even if learning in individual settings were to be less differentiated than I have argued above, individual '*learning careers*' through a range of social settings would necessarily be highly differentiated.

This analysis is not an argument against the concept of situated learning, but against simplistic accounts of situated learning which both fail to recognise all the different

kinds of learning taking place in many situations and to take into account the influences on every situation of the different learning histories the participants bring with them. To understand any situation involving several people we need to adopt two complementary perspectives. One should focus on the situation itself – its antecedents, wider context and ongoing interaction with its environment – and the transactions of its participants throughout the period of enquiry. The other should focus on the contribution of the situation to the learning careers of individual participants, the learning acquired during their 'visit'. From a situational perspective knowledge is already present in established activities and cultural norms and imported through the contributions of new participants. From an individual perspective, some of their prior knowledge is resituated in the new setting and integrated with other knowledge acquired through participation. According to the magnitude of the impact of the 'visit', their knowledge can be described as having been expanded, modified or even transformed.

Let us now apply this theoretical prospective to just two of the learning processes discussed earlier in this paper. First, learning from experience has traditionally been presented as a purely individual activity with other people being part of the experience rather than part of the learning, i.e., co-learners. The focus has been on the extraction from episodic memory of explicit descriptions of features of the experience and/or generalisable understandings of it and/or theories of action in that particular environment. The learning process is commonly described as a reflective process incorporating prior explicit knowledge as well as recent experience (and I would argue prior implicit knowledge also). But if the social nature of the situation is acknowledged, this learning process becomes more complicated. Possible understandings may be embedded in the social dimension of the situation and possible actions may be available as types of activity already familiar to other participants. Others will bring their own prior knowledge, explicit or implicit, to discussions of events and their own personal interpretations. We learn that others know things that we do not know, and that we can rely on others to contribute to certain aspects of a situation and save our own mental effort. So the individual process of making personal sense of the situation is likely to draw on a much wider range of cognitive resources, whether this is recognised or not.

Another learning process involves the application of scientific knowledge, which is publicly available if not widely understood, to practical situations. Typically, the use of a concept or idea in a new situation will involve:

(1)   Understanding the situation, which itself may require appropriate use of some prior knowledge;
(2)   Recognising that the concept or idea is relevant;
(3)   Changing it into a form appropriate for the situation; and
(4)   Integrating that knowledge with other knowledge in the planning and implementation of action

The net result of this process is (a) that the knower's capacity to think and act is enhanced by the learning involved in making the concept or idea available for use in that type of situation, and (b) that their personal knowledge of the concept is enriched

and its meaning extended by it being resituated in a new context. Thus the meaning of a concept for its knower is embedded in a cluster of experiences of using it. This cluster is formed by successive episodes of knowledge use in different situations; and it is reasonable to suggest that the most readily available examples will be those most frequently and/or most recently used, or those which made a critical impact at the time. While there will be some common features across a wide range of contexts of use and between knowers, there may also be considerable differences. Hence what may begin as publicly available scientific knowledge, which people treat as having a universal meaning, may end up as a set of differentiated variations formed by the distinctly separate learning histories of a group of individuals. Adopting a socially situated perspective on knowledge may paradoxically lead to an even greater differentiation in the knowledge held by different knowers. It is also possible that the process of resituation will lead to something more than an expanded range of knowledge use: its integration with other knowledge may amount to an example of knowledge creation.

This variation in personal understanding of what scientists would usually regard as the same concept is not readily understood by the knowers. When questioned about the meaning of the concept they will usually offer an easily recognisable textbook definition. Their knowledge of how to use the concept in practical situations will typically be tacit. They will be aware that it took some time before they found themselves able to use the concept, but have little recollection of how this came about. This theory helps us to recognise that transfer is the learning process involved in resituating some aspect of one's knowledge into a new context, and that such a process subtly changes the meaning cluster of the knowledge being transferred. But will such recognition make this learning any more explicit?

Conclusion

We have identified several different types of situation where tacit knowledge may be either acquired or used or simultaneously both acquired and used.

1) Knowledge acquired by implicit learning of which the knower is unaware;
2) Knowledge constructed from the aggregation of episodes in long-term memory;
3) Knowledge inferred by observers to be capable of representation as implicit theories of action, personal constructs, schemas, etc;
4) Knowledge which enables rapid, intuitive understanding or response;
5) Knowledge entailed in transferring knowledge from one situation to another; and
6) Knowledge embedded in taken-for-granted activities, perceptions and norms.

Sometimes more than one of these characteristics will be present in the same situation. It could be argued that (6) is a subset of (1), but none of the other categories is subsumed within another. Most of them are more likely to occur in non-formal learning settings, but this kind of learning also occurs unobserved in the interstices of formal learning contexts. Tidy maps of knowledge and learning are usually deceptive.

Having spent some time considering whether and when tacit knowledge might be made explicit and exploring some of the inherent difficulties, the question of why we

should want to make tacit knowledge more explicit, if it still enables us to do things, also needs to be addressed. Apart from the scholar's natural drive to convert all available knowledge into publications, four good practical reasons come to mind:

1)   To improve the quality of a person's or a team's performance;
2)   To help to communicate knowledge to another person;
3)   To keep one's actions under critical control by linking aspects of performance with more and less desirable outcomes; and
4)   To construct artefacts that can assist decision-making or reasoning.

Improvement of performance is particularly dependent on feedback. This can both contribute to confidence and fluency and draw attention to aspects which might be improved. The latter depends on the performer receiving some message, or making a self-diagnosis, that suggests some alterations to his or her performance which is (a) feasible and (b) has a net positive effect. This requires statements about the perform- ance which indicate with sufficient clarity just what aspect might be improved, but does not necessarily require a description of that performance. Indeed the frequent use of videorecordings by coaches suggests that brief comments on a video are more effective than extended verbal criticism. The coach can stop and point and repeat a video episode to ensure that all observers including the performer(s) are looking at and talking about the same thing, and not distracted by unimportant surface features of what is shown. It is reasonable to argue that a video and critique of a performance convey both explicit and tacit knowledge, even when the explicit aspect is only partly verbal. The expertise of the coach lies as much in the selection of material for closer observation and comment as in the comment itself, an aspect of knowledge which is easily taken for granted but becomes more obvious when one considers the role of a film director. In the absence of any recording the description of a situation or event is a highly skilled activity; we admire the ability of a short story writer to disclose meaning in apparently ordinary activities, but we may not find it in our colleagues.

So far we have been considering the problem of characterising the know-how embedded in action. The tacit knowledge which may lie behind the action raises the rather different problem of trying to explain perceptions. Recording can only show excerpts of time and space as seen from a particular position and direction: the whole picture is not available, and how do we know just where and when to look? Performers' own accounts of what they did and why can be challenged for several reasons. The account may be very sparse indeed, large tracts of taken-for-granted information will normally be excluded, their attention when performing will not be focused on remem- bering current action but deciding what to do next, accounts will be tidied up and subject to post-hoc rationalisation, etc. (Nisbett & Wilson, 1977; Tomlinson, 1999). The observer has no access to the performer's thoughts or knowledge base.

Clearly a degree of explicitness is needed not only for improving performance but also for the purpose of accountability. Some linkage between actions and outcomes is necessary if one is to take responsibility for one's actions. But the limitations to making tacit knowledge explicit are formidable, and much of the discussion about it in the literature is ill-informed if not naive. The probability is that 'thick' tacit versions will co- exist alongside 'thin' explicit versions: the thick version will be used in professional

practice, the thin version for justification, for explaining transfer possibilities, for training purposes and in evaluative research.

Near the beginning of this paper we discussed the problem of researchers finding out about the knowledge of experts, situations where circumstances increased the probability of knowledge being shared among performers and techniques whereby researchers could begin to learn a little more about the knowledge that underpins performance. There can be many benefits from making some progress in this area, and it is clearly worthwhile to pursue the problem of eliciting tacit or near-tacit knowledge. Nevertheless researchers need to be both inventive and modest with their aspirations. The prime purpose of this paper has been to draw attention to both the importance of tacit knowledge and the difficulty of investigating it.

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