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TACIT KNOWING AND IMPLICIT LEARNING

1. Introduction

It is tempting to ask about the proportion of tacit, as opposed to explicit, work process knowledge that an individual (or group) acquires in modern economic life; what is the correct blend of the two and is the importance of tacit knowledge in working life increasing nowadays.

Although these questions cannot be answered from a 'tacit knowing perspective', nevertheless, some people attempt to provide answers. A business economist estimated that the percentage of tacit (personal) knowledge in companies is in the region of 20 % to 30 % (Böhnisch, 1999). Several criticisms can be made of such a proposition:

- (a) it is not possible to quantify knowledge in such a manner. For example, how are we to measure explicit knowledge: by analysing the words used? How is the knowledge to be measured: by counting or by weighing? But, most importantly, what constitutes tacit knowledge in the first place?
- (b) not much knowledge is purely tacit since speech allows us to comment in some way on nearly everything we do and explicate almost everything we know. However, the question of whether a certain kind of knowledge is describable must always refer to a particular purpose in a particular context, for which a description may or may not be adequate/exhaustive;
- (c) the economist's assertion fails to account for the fact that pure explicit knowledge does not exist in a raw state. Symbols, words, and sentences by themselves do not contain any knowledge. They become meaningful through a tacit act of 'sense-reading', performed by someone who sees *beyond* the symbols to that which they refer (and who may soon forget the words while still keeping their content in mind);

- (d) last but not least, the economist's proposition misses the point of the 'tacit knowing' debate, as do the questions outlined above. The debate is not about a particular *kind of knowledge* that is to be distinguished from and added to explicit knowledge; it is about a different *view of knowledge* in general ⁽¹⁾.

This paper begins by presenting a brief overview of the 'tacit knowing' view and questions the intellectualist and objectivist view of knowledge (Section 6.2). It continues by distinguishing different meanings of the term 'tacit' and refers to different types of tacit knowledge (Section 6.3). Finally, some implications for the acquisition of knowledge are discussed (Section 6.4) ⁽²⁾.

2. Work-process knowledge as a substance?

Talking about 'knowledge' (as distinct from competence, skill, mastery of an art, understanding, ability, judgement, etc.) is a way of identifying the invisible cognitive repertoires that underlie competent behaviour: that is, a hidden mental substance (in the form of propositions, programmes, rules, algorithms, theories) as well as mental processes dealing with that substance. However, in ascribing 'work-process knowledge' to workers, we impute to them not mentally stored knowledge, but the ability to perceive, to think, and to act skilfully, to *do* certain things in an expert-like way. We are interested in *knowledge in use* rather than *knowledge as a state*. That is why a theory of tacit knowing ought to come into play if we are interested in work-process 'knowledge'.

The tacit knowing view:

- (a) concerns *knowing*, not in the sense of storage places and their contents, but processes (e.g. perception, judgement, action, thought, discernment, contrivance) and underlying human dispositions ⁽³⁾;

⁽¹⁾ For a brief exposition of the main differences between the tacit knowing view and the cognitive view see the table in Neuweg (2001, pp. 22, 23).

⁽²⁾ For a closer look at the tacit knowing view, we particularly recommend the following works : Michael Polanyi (1969, 1975 and 1962); Gilbert Ryle's brilliant analysis in *The concept of mind* (1949); the taxonomy of levels of human skill, and the taxonomy's philosophical basis in the works of Dreyfus and Dreyfus (e.g. 1986); summaries and discussions of empirical results on implicit learning, such as in Reber (1993) or Berry and Dienes (1993), and, for German readers, the comprehensive exposition in Neuweg (2001).

⁽³⁾ For this reason, the tacit knowing debate is less concerned with the acquisition of knowledge of facts.

- (b) focuses on the relationship between knowing and its articulated counterpart;
- (c) argues that ‘we know more than we can tell’. This proposition has one or both of the following meanings:
 - (i) some human dispositions are ‘unformalisable’. In this case, to ‘tell’ can be seen to mean programming a computer so that, by means of rules, it simulates a knowing person with regard to a particular disposition;
 - (ii) some human dispositions are ‘unteachable’ solely by means of verbal instruction. In this case, to ‘tell’ means instructing learners verbally in such a way that they follow in the teacher’s footsteps with regards to a particular disposition (that is, so that they understand and replicate the teacher without having first-hand experience or a demonstration).

Both meanings are informed by the conviction that it is dangerous to believe that knowledge of propositions, rules, or theories is a sufficient condition for knowing and that it is even dangerous to believe that such knowledge is always a necessary condition for knowing. Furthermore, an important corollary is the assertion that all (even the most academic) professions have a practical (craft) side, which, once learned, is not detachable from the knowing person.

Such a view stands in opposition to traditional thinking on human insight and action. From the intellectualist or cognitive viewpoint ⁽⁴⁾ knowledge is essentially propositional. This means that everything we do is seen as derived from propositions in our head and from thought processes dealing with these propositions. From this perspective, to do something intelligently is to employ both theory and practice, but practice is seen as nothing more than applied theory. (This view admits that we are often unable to articulate how we proceed in carrying out a task. However, this is said to indicate the proceduralisation of previously conscious rules into procedures, the execution of which is now mere routine.) From this viewpoint teaching is merely the transfer of information, and learning is nothing more than the storage of information.

The acceptance of this view implying the existence of conscious and unconscious ‘mental’ rules and schemata that ‘cause’ intelligent behaviour, has important consequences. For the scientist, it means that in order to detect the causes of skilful action, research in work-process knowledge has to focus on the mind and its content and architecture, rather than on observable behaviour over time. It also means that the

⁽⁴⁾ For a detailed critique of the cognitive view see Ryle (1949) and Neuweg (2000).

elicitation and codification of an expert's knowledge is of theoretical as well as practical importance.

To view knowledge as a mass of conscious and unconscious propositions suggests that it is more or less easily detachable from knowing subjects. This would have important practical benefits. For example, externalising 'the substance' hidden in an expert's brain would enable us to shorten a beginner's learning process. Indeed, if all we knew were transposable into words and detachable, we could impart many years of experience to a learner in just a few weeks⁽⁵⁾. Furthermore, if people's knowledge is seen in terms of rules and external procedures, these are replaceable, either by machines/technology or by other people.

Educationalists as well as business economists are not the only ones to find the idea of 'objective' knowledge attractive. Famous proponents have already been seduced. Popper (1972, pp. 107, 108) for example, argues for the existence of a so-called 'world 3' of objective thoughts, existing independently of and in addition to the (physical) 'world 1' and 'world 2' (the world of states of consciousness, mental states or dispositions to act). Imagine, he says, that some catastrophe destroyed our machines and tools together with our subjective knowledge of their use, while libraries, as well as our capacity to learn from books, survived. He argues that we would not have difficulty in rebuilding our civilisation.

But, is this the case? In the late 1960s, a Canadian research laboratory succeeded in constructing a special device - the so-called TEA laser. Collins (1985) studied attempts by British laboratories to build copies of the device along the lines of Popper. The findings outlined below strongly challenge his thoughts:

- (a) no scientist succeeded in building the laser by using only the information found in written sources; a crucial component of knowledge was acquired through personal contact;
- (b) no scientist succeeded in building the laser when the informant was a 'middle man' who had not built the device himself;
- (c) even where the informant had built the device himself, the learner was unlikely to succeed without some extended period of contact with the informant;

⁽⁵⁾ In the German weekly newspaper *Die Zeit*, for example, Niki Lauda dreams of 'how wonderful it would be if I could transmit the rich store of my experience, my knowledge, to my sons Lucas and Matthias. Just take a modem or an adapter, suddenly a flow of data would start its journey' (Lauda, 2001, translation G. N.).

(d) the flow of knowledge was partly obscured, so that scientists did not know whether they had the relevant expertise until they put it into practice.

Collins concluded that tacit knowledge is a crucial component in laser building and that, therefore, written information alone is inadequate.

From the intellectualist point of view, such findings are surprising. Given that intelligent action is the outcome of deliberation and knowledge, why are experts unable to express all that they are able to do in words?

On the contrary, it would appear that practice is not always 'a client' of theory. First, there is empirical evidence challenging the intellectualist viewpoint. If knowing and deliberating are *necessary* conditions for skilful action, then what about the skilled expert who can perform tasks intuitively? Following Polanyi (1962, p. 49) 'the aim of a skilful performance is achieved by the observance of a set of rules which are not known as such to the person following them.' Although, for example, the cyclist knows how to ride a bicycle, he is unable to state the rule – to compensate for a given angle of imbalance we must take a curve on the side of the imbalance, of which the radius should be proportional to the square of the velocity over the imbalance. On the other hand: If knowing and deliberating were *sufficient* conditions for intelligent action, then what about theorists who are unable to do what they know? In an experiment conducted by Renkl et al. (1994), for example, it was shown that graduate students of economics were less successful than laymen in controlling a computer-based economic simulation, perhaps not in spite of, but because of, their broader base of explicit knowledge. It is also well known that expert performance can break down if subjects try to focus on specific components of a skill and attempt to govern execution according to strict rules (see for example Masters, 1992).

Second, there is a strong logical argument against the intellectualist point of view. If action is the result of deliberation, intelligent action presupposes intelligent deliberation. Following the intellectualist construction, deliberation must be the result of further instruction about being intelligent. To avoid an infinite regression, the intellectualist must suppose deliberation to be intelligent in itself. Such a supposition is not just wrong – people may deliberate very unintelligently – but it is also inconsistent. If there are second-order acts that are intelligent per se, why should there not also be first-order acts that are intelligent in the same manner?

3. The concept of tacit knowledge

It is a fact that people need not necessarily think before acting intelligently: consider intelligent speakers who talk fluently because they do *not* contemplate about the words to use before they speak. Also, people cannot prescribe all their intelligent behaviour: infinite regression would mean one could never start acting at all. In what sense, then, are we allowed to ascribe 'knowledge' to people?

It is important to distinguish carefully between knowledge in the psychological sense (first person knowledge) and knowledge constructed from the observer's point of view (third person's knowledge). According to the 'intellectualist' viewpoint, the intuitive actor has propositional knowledge 'in mind', albeit unconsciously. Ryle (1949) has shown that this point of view is subject to a category mistake. The ascribed knowledge-base merely functions as a construction to describe, explain and predict behaviour. The only objective mode of existence for this knowledge is behaviour over time, or, as Ryle (1949, p. 57) puts it: 'Overt intelligent performances are not clues to the workings of minds; they are those workings.' People behave as they do not because they have unconscious rules in mind but, at best, as if they had such rules in mind. In this sense, tacit knowledge is essentially implicit in one's behaviour and does not consist of internally represented rules (although it can be partly reconstructed and symbolised, either by the subject or by the observer). Memory is not a storage place of symbolic representations but rather is 'the name we give to the capability of behaving in similar ways in similar situations' (Clancey, 1990, p. 61).

This is not to say that the relationship between know-how and explicit knowledge is just one of practice to its description; it is also one of practice to its intrinsic or extrinsic instruction. But the question, 'What knowledge does the expert unconsciously apply?' should be replaced by two totally different and more fruitful questions:

- (a) to what extent does third person knowledge *describe* the knowledge of the first person? Or, to put this in another way, to what extent can explicit 'know-that' simulate 'know-how'?
- (b) to what extent is explicit knowledge suited for *instructing* 'know-how'?

3.1 Meanings of the term 'tacit'

We are now ready to look at three different – though interrelated – meanings of the term 'tacit', which appear in the debate.

First, tacit knowing often means doing something intelligently in an intuitive manner. Experienced workers ordinarily reveal a kind of 'knowledge' that does not stem from a prior act of deliberation. Although somebody might be able to articulate corresponding rules before or afterwards, there need not be any self-instruction during the course of an action. (In some sense, every kind of acting is intuitive as it is impossible to do something and to reflect upon one's own action at the same time.) Consequently, "thinking what I am doing" does not connote "both thinking what to do and doing it". When I do something intelligently, i.e. thinking what I am doing, I am doing one thing and not two. My performance has a special procedure or manner, not special antecedents.' (Ryle, 1949, p. 32);

Second, by reflecting on our actions we can try to make descriptions of the knowing that is implicit in them. Knowing-in-action becomes knowledge-in-action. It is important to note that the term knowing refers to a dynamic quality whereas facts, rules or theories are static. Therefore, descriptions of knowing-in-action are always constructions; that is, 'attempts to put into explicit, symbolic form a kind of intelligence that begins by being tacit and spontaneous' (Schön, 1987, p. 25). This leads to the second meaning of tacit knowing as the residue left unsaid by a defective articulation. In this stronger sense, tacit knowledge means that 'we can know more than we can tell' (Polanyi, 1983, p. 4): somebody is able to judge or act skilfully without being able to articulate what it is that he knows or, at least, able to articulate it appropriately. The workaday life of the professional, Schön argues, depends heavily on this kind of knowing:

'Every competent practitioner can recognise phenomena – families of symptoms associated with a particular disease, peculiarities of a certain kind of building site, irregularities of materials and structures – for which he cannot give a reasonably accurate or complete description. In his day-to-day practice he makes innumerable judgements of quality for which he cannot state adequate criteria, and he displays skills for which he cannot state the rules and procedures. Even when he makes conscious use of research-based theories and techniques, he is dependent on tacit recognitions, judgements, and skilful performances' (Schön, 1983, pp. 49-50).

Even if the actor is unable to fully articulate what it is that he knows, this need not impair our ability to detach knowledge from people. The third person analysis may reveal the first person knowledge. In a third and still stronger sense tacit knowledge means that even the third person is unable to describe intelligent action in terms of rules. This is a crucial point. Some psychologists think of tacit knowledge as the collective unconscious rules computed by an actor in a way that careful analysis reveals. It may well be that, in

some cases, this view is correct. However, are these cases pertinent when we consider the ill-structured domains of human expertise and their environmental complexities? Rules are abstract and standardised, whereas an expert has to deal with concrete cases and their variations. As no general proposition can fit every detail of a particular state of affairs, the expert must be sensible. However, if we view his good sense as a product of the acknowledgement of further general principles, we end up in an infinite regression of rules and principles. To put it another way, 'To a partly novel situation the response is necessarily partly novel, else it is not a response' (Ryle, 1976, p. 125). Note that the point here is not that skilful acting is intuitive; it may well be highly conscious, but it does not follow strict and formalisable rules. It is creative. This is Ryle's point against the reduction of thinking to mere computation:

'When considering abstract questions about the intellect we are apt to treat arithmetical computation as its most typical exercises – as if the best thinkers in their best moments are doing in their heads the sort of things that computing machines do, only much faster, in their complex insides. I don't know where this superstition comes from. Computation is, though very important, so low a form of thinking that a well-trained cashier can do lengthy and complex computations while thinking about something else. Moreover, pure computation-tasks offer no scope whatsoever for originality, talent, flair, horse sense, taste, judiciousness in the weighing of evidence, or constructiveness in the building up of chains of argumentation' (Ryle, 1979, p. 52).

We sometimes refer to tacit knowledge of this kind as 'common sense'. To deepen our insight into this meaning of tacit, it is helpful to distinguish between two kinds of action (see Collins and Kusch, 1998). On the one hand, mimeomorphic actions maintain routines. Examples include a production-line type action such as that portrayed by Charlie Chaplin in his *Modern Times* film; the standard golf-swing; or simple arithmetical operations. Anyone or anything that can follow the set of rules describing the behaviour can, in effect, reproduce the act. Hence these acts are machinelike and mechanisable.

Polymorphic actions, on the other hand, are those in which the same action can and must be instantiated by an indefinite number of different behaviours, depending on the context at hand. Although this kind of acting is usually 'rule following' and sometimes 'rule establishing', it is very difficult to describe the rules that we follow when we are performing polymorphic actions. Collins (1995) gives an instructive example:

‘(It) is clear that there are rules applying to my actions as a pedestrian because I will get into trouble if I break them – perhaps by walking too close to the single person on an otherwise deserted beach, or by trying to keep too far away from others in a crowded street – but I cannot encapsulate all that I know about the proper way to walk in a formula. The little bits of rule that I can provide – such as those in the previous sentence – are full of undefined terms. I have not defined “close”, “distant”, nor “crowded”, nor can I define all my terms on pain of regress. What is more, what counts as following the rule varies from society to society and situation to situation. A set recipe for walking will be found wanting on the first occasion of its use in unanticipated circumstances; perhaps the next people on the beach will be actors in a perfume advertisement playing out the mysterious attractiveness of a particular aroma, while the next people in the street will be living in the time of a contagious epidemic disease!’

Note that to act skilfully in working life, we mostly have to act with insight and not machinelike. A common and effective form of industrial disruption is to act too uniformly: to ‘work to rule.’ This point becomes important, in particular where bureaucratic work systems are replaced by individual and organisational flexibility.

3.2 Three different types of tacit knowledge

It should be pointed out that use of the term tacit knowledge transcends the realm of action. This is apparent when we distinguish between three different types of tacit knowledge.

3.2.1 Tacit knowing-how

Whenever we speak of art, e.g. the art of cooking, the art of teaching, or the art of managing, we refer to ‘tacit knowing-how’, the tacit side of expertise that is more than, or different from, the application of theory. Tacit knowing-how comprises all dispositions to judge or act and forms what Polanyi (1962, p. 87) has called the ‘ineffable domain’. Polanyi emphatically invites us to accredit ‘skills and connoisseurship as valid, indispensable, and definitive forms of knowledge’ (1975, pp. 32, 33), not least because of the need to bring the theoretical body of science to bear on experience:

‘Students of chemistry, biology, and medicine [...] seek to bridge the gap between the printed text of their books and the facts of experience. They are training their eyes, their ears, and their sense of touch to recognise *the*

things to which their textbooks and theories refer. But they are not doing so by studying further textbooks. They are acquiring the skills for testing by their own bodily senses the objects of which their textbooks speak. [...] Textbooks of chemistry, biology, and medicine are so much empty talk in the absence of personal, tacit knowledge of their subject matter. The excellence of a distinguished medical consultant or surgeon is due not to his more diligent reading of textbooks but to his skill as a diagnostician and healer – a personal skill acquired through practical experience. His professional distinction therefore lies in a massive body of personal knowledge.’ (1975, pp. 31, 32).

The tacit component in connoisseurship and skills is easy to see if we consider motor skills and impressionistic knowledge. It is difficult to explain how to juggle five balls, how to class cotton or how to diagnose a patient by interpreting his facies. Typically the expert will refer to the ‘right feel’. But it is important to see that there is a tacit component to even the most abstract forms of judgement and action. Take, for example, our ability to reason correctly without considering the rules of logic, the art of applying theories in a context-sensitive way, or maintaining intelligent practices for which there are no written rules at all, e.g., the practice of invention.

3.2.2 *Tacit knowing-that*

In our behaviour we also exhibit an abundance of ‘tacit knowing-that’, which is difficult, if not impossible, to describe. This is ‘knowledge taken for granted’; knowledge based on our cognitive background, interpretative frameworks, viewpoints, paradigms, mental models and beliefs. Once more, Polanyi (1983, pp. 64, 65) gives us an instructive example of the way tacit knowing-that functions. He refers to a letter published by *Nature*, the author of which

‘had observed that the average gestation period of different animals ranging from rabbits to cows was an integer multiple of the number p . The evidence he produced was ample, the agreement good. Yet the acceptance of this contribution by the journal was meant only as a joke. No amount of evidence would convince a modern biologist that gestation periods are equal to integer multiples of p . Our conception of the nature of things tells us that such a relationship is absurd, but cannot prescribe how one could prove this.’

Following Searle (1983, Ch. 5), it would be a hopeless endeavour to specify all our tacit beliefs, not only because a great number of them are submerged in the

subconscious but also for two further reasons. First, they are not individuated: we do not know, for example, how to count them. Second, in trying to explicate our tacit beliefs we would encounter states that are too fundamental to be called beliefs or elements of 'know-that', for example, 'objects that offer resistance to touch': whatever one does with objects, one does not in addition think subconsciously that they offer resistance to touch.

3.2.3 *Tacit roots of explicit knowledge*

If we use the prevalent signs for representing knowledge – e.g. the spoken sentence, the textbook or the database – are we really talking about knowledge? Clearly we are not. Sound waves, printing ink, and magnetic disks are just physical objects, not knowledge, until somebody understands what they mean. Knowledge is a psychological phenomenon, not a physical one. Consequently, tacit knowledge may also refer to the tacit roots of all our explicit knowledge, i.e. to its semantic and pragmatic basis. 'There is a possibility of knowledge only if one *understands the concepts* used and the contexts in which the sentences are normally used, and that is not the same as having the ability to repeat the sentences parrot-fashion' (Molander, 1992, p. 14). Furthermore, as it is meaning that constitutes knowledge, 'a *wholly* explicit knowledge is unthinkable' (Polanyi, 1969, p. 144). All knowledge is fundamentally tacit, because deprived of their tacit coefficients, all spoken or written words would be meaningless; explicit knowledge must rely on being tacitly understood and applied to be knowledge at all.

4. Transmitting and acquiring tacit knowledge

It is widely acknowledged that the acquisition of practical knowledge requires learning by doing. 'We learn *how* by practice, schooled indeed by criticism and example, but often quite unaided by any lessons in the theory' (Ryle, 1949, p. 41). Indeed, shifting the emphasis from 'expertise in verbalising' to 'expertise in doing' supports the view that 'what we need is not so much theories, articles, books, and other conceptual matters, but, first and foremost, concrete situations to be perceived, experiences to be had, persons to be met, plans to be exerted, and their consequences to be reflected upon' (Kessels and Korthagen, 1996, p. 21).

Given that experts always know more than they can tell and even more than anyone could ever formalise, it seems clear that expert knowledge cannot be transmitted by prescription alone. Hence, tacit knowledge, at least if we consider the strong sense of the term, has to be learned implicitly: 'An art which cannot be specified in detail cannot be transmitted by prescription, since no prescription for it exists' (Polanyi, 1962, p. 53).

Some authors even define the concept of tacit knowledge by its didactic implications, as does Molander (1992, p. 11):

‘Knowledge transmitted through models or *exemplars* – through exemplary action, as in the master-apprentice relationship – and knowledge which is attained through *training* and *personal experience* may be called ‘tacit knowledge’. This is a good label because the core of such knowledge does not consist of verbal or mathematical formulations, it consists of abilities to *make judgements* and to *do things* in practice, skilfully and with insight.’

Although tacit knowledge is not teachable, it is coachable. What must be left unspoken is attained through personal experience and transmitted within master-apprentice relationships and cultures of expert practice. Polanyi’s analysis of tacit knowledge leads him to advocate apprenticeship as indispensable for the acquisition of tacit knowledge. He emphasises that skills, whether practical or intellectual, can be passed on only by example from master to apprentice: ‘By watching the master and emulating his efforts in the presence of his example, the apprentice unconsciously picks up the rules of the art, including those which are not explicitly known to the master himself’ (Polanyi, 1962, p. 53). Because the range of diffusion is restricted to that of personal contact, traditions of how to act skilfully may be lost if they fall into disuse for the period of a generation. Polanyi gives the example of violin-making (1954, p. 387): ‘It is pathetic to watch the endless efforts, equipped with microscopes and chemistry, with mathematics and electronics, to reproduce a single violin of the kind that the half literate Stradivarius turned out as a matter of routine more than 200 years ago.’ Furthermore, Polanyi argued that this apprenticeship must be an uncritical one. The more hidden the rules, the more the apprentice must surrender himself uncritically to the imitation of the master and the more he has to be convinced that there is something important to learn. Indeed, the paradox of learning a new competence lies in the fact that ‘a student cannot at first understand what he needs to learn, can learn it only by educating himself, and can educate himself only by beginning to do what he does not yet understand’ (Schön, 1987, p. 93).

Within the realm of tacit knowledge, Polanyi pays special attention to connoisseurship. This faculty has to be trained in a ‘case-based manner’ ⁽⁶⁾. Schools and universities

⁽⁶⁾ The importance of case-based instruction can be exemplified by the practice of Common Law (Polanyi, 1962, pp. 53, 54). Courts follow precedents considered in other courts, for they see the rules of law embodied in prior decisions. In doing so, they recognise that practical wisdom is more truly embodied in action than in expressed rules of action.

often teach what to do in situations of a certain type, representing these situations as verbal vignettes. However, in reality, we have to react to situations, not words. To choose a particular course of action requires a correct subsumption of the concrete situation in general terms. This faculty of judgement and discrimination is essential for applying the appropriate rules if there are any. But it cannot be developed simply by laying down further rules; for we must learn to recognise a situational pattern in which the elements may vary and we have to consider that the meaning of a specific situation is always context-related (see Neuweg, 2001, Ch. 12, for more details on expertise and pattern recognition).

Beyond these more or less obvious didactic ideas, further hints can be derived from studying Polanyi's concept of tacit knowledge more closely. The concept basically rests on analysis of the architecture and workings of human consciousness. Within this framework, learning appears as a process of 'interiorisation', of making things function as if they were part of our body (see Neuweg, 1998). The learning process aims to instrumentalise elements, objects, actions, theories, in the service of some purpose. Therefore, the master ought to encourage learners to direct their attention primarily to the object under consideration, and only in a 'subsidiary' manner to the theoretical and practical means applied.

To establish relationships between parts and wholes and between means and ends, in effect to endow parts and means with meaning, the learner must concentrate on the 'distal' (Polanyi), the situation's 'back-talk' (Schön) and the overall context or purpose. By doing so, the learner becomes aware of elements, objects and actions not in themselves but as tools; in terms of operational results achieved through their use (⁷). If learners experience their actions

'only subsidiarily, in terms of an achievement to which they contribute, its performance may select from them those which the performer finds helpful, without ever knowing these as they would appear to him when considered in themselves. [...] hence the practical discovery of a wide range of not consciously known rules of skill and connoisseurship which comprise important technical processes that can rarely be completely specified, and even then only as a result of extensive scientific research' (Polanyi, 1962, p. 62).

⁷) The importance of looking at outcomes can be seen in a simple example. In learning to steer a large and slow-moving boat, it is very helpful to pick a distant point to aim for. Then the details of turns and corrections take care of themselves (personal note from D. Schmitt).

Polanyi would have agreed strongly with Schön (1987, p. 158) when he said that the learner needs to grasp a skill ‘as a whole to grasp it at all [...]; for the pieces tend to interact with one another and to derive their meanings and characters from the whole process in which they are embedded.’ This is not to say that all tacitly learned pieces are unspecifiable; merely that drawing attention to them would cause a deterioration in performance and deprive them of their meaning.

5. Caveats and qualifications

Parts of the tacit knowing debate tend to overemphasise the difference between theoretical and experiential knowledge, and to overlook the benefits of critical reflection (this being the reason for Fischer, 2000, to prefer the term ‘work process knowledge’ to experiential or tacit knowledge.) The following four remarks therefore should be made.

a) Much of what we learn is picked up incidentally, and often one’s learning is far more effective if the mind does not interfere with analysis and focusing on rules. However, even if work-process knowledge is considered largely to be tacit knowledge, this does not imply that it has to be learned wholly implicitly, i.e. without explicit instruction and without conscious attempts to detect underlying rules. In most cases learning involves some balance or oscillation between relatively controlled, analytical, and more spontaneous, integrative processes, the right blend of processes depending on the person and the subject matter being learned. In particular, it is sometimes necessary to draw the learner’s ‘focal’ attention (Polanyi) to the details and to formulate pedagogically helpful rules. For this reason, a master is not necessarily a good teacher for beginners.

Although Polanyi argued that ‘an unbridled lucidity can destroy our understanding of complex matters’ (1983, p. 18), he was fully aware of the benefits of analysis, and thought that ‘an oscillation of detailing and integrating’ is ‘the royal road for deepening our understanding of any comprehensive entity’ (1997, p. 333). A continual journey back and forth between analysis and synthesis is highly desirable, provided that analysis helps to render more of the tacit components focally known, without causing irreparable disintegration in our central focal meaning. Polanyi gives the example of motion studies, which tend to paralyse a skill, but improve it when followed up with practice. In cases of this kind, ‘the detailing of particulars, which by itself would destroy meaning, serves as a guide to their subsequent integration and thus establishes a more secure and more accurate meaning of them’ (Polanyi, 1983, p. 19). Furthermore, in many cases the destructive effects of analysis can be counteracted by explicitly stating the relation

between the particulars. 'Where such explicit integration is feasible', says Polanyi (1983, p. 19), 'it goes far beyond the range of tacit integration.'⁽⁸⁾.

b) Polanyi's idea of a see-saw balance between experience, analysis, reflection, and integration is closely related to the more elaborate concept of reflection to be found in the work of Schön (1983, 1987). If a practitioner reflects in the midst of action, he focuses 'interactively on the outcomes of action, the action itself, and the intuitive knowing implicit in the action' (Schön, 1983, p. 56), always attending to the peculiarities of the situation at hand. This is what Schön calls 'reflection-in-action'. He makes clear that it would be a mistake to view the alternation between analysis and integration as nothing more than an intermediary state in the process of becoming an expert. The very practice that leads to expertise also endangers it: tacit knowledge is often tacit blindness. Therefore, the question, 'how could one combine a critical stance towards knowledge with the protection and cultivation of 'tacit' aspects of knowledge, if this is at all possible', has rightly been identified as 'a key problem concerning "unarticulated knowledge"' (Molander, 1992, p. 10). The expert is not only a person who acts intuitively, but also someone who continues to study in his or her field.

c) In many domains the emphasis on tacit knowledge should not seduce us into underestimating the need for a broad theoretical understanding for skilful action. Take the example of medical diagnosis, to which Polanyi often refers. The identification of a specific disorder surely requires a massive experiential background; but the expert's ability to perceive significant patterns of illness is also dependent upon his knowledge of medical theory. In general, the relationship between tacit knowing and the professional knowledge taught in schools should be treated as an open question, the answer to which is task-dependent.

What remains tacit and has to be learned experientially, however, is the knowledge of how to apply theory to phenomena. Application can never build on a theory of application. Furthermore, what might become tacit in the course of time are the details of theory in its propositional form. The expert may be aware of the theory only in terms of the phenomena that are seen in its light. To understand a situation, one does not need to be fully conscious of what one has studied to use it interpretively: Polanyi argues that 'a theory is like a pair of spectacles; you examine things by it, and your knowledge of it lies in this very use of it. You dwell in it as you dwell in your own body and in the tools

⁽⁸⁾ Nevertheless, one must see that an explicit integration cannot replace its tacit counterpart. The skill of a driver cannot be replaced by schooling in the theory of the motorcar, nor are the rules of rhyme or prosody necessary conditions for enjoying a poem and indeed, can lessen enjoyment.

by which you amplify the powers of your body' (Polanyi, 1975, p. 37; see also Broudy, 1970, for an analysis of 'tacit knowing with').

d) Given that instruction and theoretical studies form an essential part of a curriculum, what role do they play exactly? Remembering that all explicit knowledge has, and must have, tacit roots, it is clear that not only do we sometimes need a great deal of instruction to understand experience, but we also need a great deal of experience to understand the meaning of a theory or what is contained in the instruction we are receiving. What learners see is largely dependent on what they hear the master say; yet the meaningfulness of what they hear is in itself dependent on their capacity to see what the words indicate. That is why Schön (1987, p. 103) pleads for instructions in the context of the student's doing: 'Instructions are always and inevitably incomplete. Unless we already know how to do the thing in question, there is always a gap between the instruction and the action it describes – a gap we are unlikely to detect, except when we listen in the mode of operative attention.' Polanyi strongly agrees that rules should be observed within the context of skilful performance, as 'the premises of a skill cannot be [...] understood if explicitly stated by others, before we ourselves have experienced its performance, whether by watching it or engaging in it ourselves.' (1962, p. 162).

Both theoretical and experiential learning may, therefore, be enhanced if connected in parallel. If we synchronise language and objects, we always find a dual movement of comprehension; if the two fall apart we risk the danger of a lack of comprehension in both realms. To illustrate this dual act of sense reading, Polanyi uses the vivid example of a medical student attending a course in X-ray diagnosis of pulmonary diseases. He watches shadowy traces on a fluorescent screen and hears the radiologist commenting to his assistants. At first he can see nothing that is talked about nor does he understand the language used. But as he goes on listening for a few weeks the pictures begin to make sense – and so do the comments made about them:

'Thus, at the very moment when he has learned the language of pulmonary radiology, the student will also have learned to understand pulmonary radiograms. *The two can only happen together.* Both halves of the problem set to us by an unintelligible text, referring to an unintelligible subject, jointly guide our efforts to solve them, and they are solved eventually together by discovering a conception which comprises *a joint understanding of both the words and the things.*' (Polanyi, 1962, p. 101, emphasis by the author)

From this we can learn a lot about the proper relationship between 'theory' and 'practice'.

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