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'Tacit knowledge' - a new hypothesis

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Abstract

'Tacit knowledge' and 'explicit knowledge' are ambiguous terms and the relationship between them, critical to 'knowledge management', is unclear. If some 'tacit knowledge' is inherently non-verbalizable (Polanyi 1966a) models such that of Nonaka and Takeuchi (1995) may be invalid. Dewey and Bentley (1949) presented a framework of 'knowing' as sign-process which links both forms of 'knowledge'. Evidence for their model is reviewed and its validity tentatively established. Examples of 'tacit knowing' clearly show indications of non-verbal sign-process, and it is concluded that the transmutation of 'tacit' into 'explicit' 'knowledge' involves changes in the form of sign-process. Authorities differ on whether and to what extent such transmutation is possible.

Introduction

There are a number of problems with Nonaka and Takeuchi's model of knowledge creation (Nonaka & Takeuchi 1985), and thus with all knowledge management models built on their framework (e.g. Baumard 1999; von Krogh, Ichijo and Nonaka 2000; see Gourlay 2000 for a review). Perhaps the most critical of these concerns the nature of 'tacit knowledge' and the possibility of transmuting it in to 'explicit knowledge'. Nonaka and Takeuchi claimed to follow Polanyi (1966a), who they credit with identifying 'tacit knowledge', but neglect to take into account of his view that 'tacit knowledge' is inherently 'tacit' and therefore not expressible in words. Indeed, if it were the case that such transformation is impossible, then much of the force of their model would be lost.

My intention in this paper to outline and tentatively justify a framework that does enable us to see how 'tacit' and 'explicit' knowledge are linked, and on this basis to be able to state clearly what kind of process the transmutation process is. In addition I will indicate some of the practical consequences for research and knowledge management that would follow, and note some opinions on the possibility of expressing 'tacit knowledge' in words.

'Tacit knowledge' and 'explicit knowledge'

If these two terms are labels for two forms of 'knowledge' then our understanding of 'tacit knowledge' might benefit from expanding on 'knowledge' itself. Nonaka and Takeuchi reported that "Western philosophers have generally agreed that knowledge is "true justified belief" ..." (Nonaka and Takeuchi 1995:25). This is not quite so. According to the recently published *Routledge Encyclopaedia of Philosophy* (Craig 1998) "Knowledge ... is true warranted belief." The author of this entry warns readers against treating warrant as merely another term for 'justified' for justification only depends on sound reasoning that itself may rest on false premises - thus "justification is not sufficient for warrant." (Klein 1998). How knowledge is warranted is a matter of debate amongst epistemologists, but Klein's review shows that it centres on providing reasons for beliefs that show that the belief was not dependent simply on cognitive luck.

If 'knowledge' is 'true warranted belief' then 'tacit knowledge' is 'tacit true warranted belief', and 'explicit knowledge' 'explicit true warranted belief'. Since epistemologists have largely been concerned with propositional knowledge (Klein

1998), for which 'explicit knowledge' is an alternative term, we can take it that 'explicit knowledge' is equivalent to the 'knowledge' with which epistemologists have been concerned. That is, it is a form of knowledge justified by reasoning that is warranted.

A 'tacit true warranted belief', on the other hand, seems implausible if not impossible. If, as Polanyi insisted, 'tacit knowledge' is unspoken and unspeakable, it is difficult to see how reasons could be produced to warrant such a belief. Thus 'tacit knowledge' might be true, but as a tacit belief, its warrant cannot be demonstrated. This provides grounds for the suspicion that, at least on the basis of contemporary 'Western' philosophical definitions, 'tacit knowledge' is, perhaps, not a form of 'knowledge'.

Of course this conclusion is in a sense a truism, for if epistemologists' have only been concerned with propositional i.e. explicit knowledge, we already know that 'tacit knowledge' is not 'explicit knowledge'. In this context it is interesting to note that although the *Routledge Encyclopaedia of Philosophy* provides entries for knowledge (Klein 1998), and for tacit knowledge (Delaney 1998), no attempt was made to consider the relationship between the two terms. Moreover, Klein notes that there are three varieties of knowledge – know-how or skill, acquaintance, and propositional knowledge - but only deals, like the other epistemological views he discusses, with the latter. In so far as 'tacit knowledge' is equivalent to know-how this indicates that either epistemologists *do* consider 'tacit knowledge' a form of knowledge, but have not yet considered how it might relate to that form on which they have concentrated their efforts, or they too have yet to distinguish two distinct things. Thus if 'tacit knowledge' or 'know-how' is the same as 'skill' (Klein 1998) this again suggests that 'tacit knowledge' and 'explicit knowledge' are actually two different 'things' for which the same label, 'knowledge', is somewhat confusingly used since while 'knowledge' and 'skill' are commonly thought to be related, they clearly are not the same thing.

Another possibility we must consider is that the label 'tacit knowledge' refers to a number of different things. Janik (1988) has produced a comprehensive review of 'tacit knowledge' types, and distinguished between two senses and five varieties of 'tacit knowledge'. Barbiero (n.d./2000) provides a different categorization of 'tacit knowledge', but confirms the idea of two basic categories, one inherently not expressible in words.

Types of 'tacit knowledge' (Janik 1988: 54-8)

things not put into words	*things inexpressible in words*
trade secrets	'knowledge by acquaintance or familiarity' e.g. sounds, smells
things overlooked e.g. craft knowledge/skill	"the open-textured character of rule-following" acquired through practice
presuppositions	

In the first case 'tacit knowledge' is simply 'knowledge' that has not been put into words for reasons that do not involve the nature of what is known – i.e. for reasons of secrecy and power, because no one has bothered (often because the knowers are low status people), or because it concerns presuppositions we all generally hold (tomorrow *will* come). Wagner and Sternberg (1986) similarly defined 'tacit knowledge' as knowledge that is not *usually* (my italics) openly expressed or stated. Such 'tacit knowledge' does not pose an insurmountable problem since making it explicit simply requires the kinds of tool Wagner and Sternberg have developed, efforts to overcome or get around power-play, and attention to what subordinates actually know.

Janik claimed that the second type of 'tacit knowledge' *cannot* be expressed in words because, following Wittgenstein's lead, it relates to sensuous experience or practice (Janik 1988: 56; see also Josefson 1988). We 'know' what coffee smells like, how a particular musical instrument sounds, but these kinds of 'knowledge' cannot be expressed in words or other explicit communicable form (Janik 1988; see also Janik 1990; Prazitz 1990). Polanyi too was concerned with 'tacit knowledge' in this sense but saw it differently from Janik. His main argument was that 'tacit knowledge' (or rather, 'tacit knowing') was involved in the way we resolve the particulars of a focal entity into that entity. That is, we are able to perceive, for example, the elements that make up someone's face into their face, but cannot say how we do this. Further, having 'resolved' the particulars into the whole, we only 'tacitly' know the particulars we previously apprehended. Like Janik, basing himself on Wittgenstein, most of Polanyi's examples also relate to 'practice', to doing things. (Polanyi also wrote of 'tacit knowing' involving 'foreknowledge' (Polanyi 1961: 133), a form that can safely be disregarded in this context (see Gourlay 2000)).

The real problem for knowledge management therefore concerns Janik's second class of 'tacit knowledge': that which, it is claimed, cannot be expressed in words. There also remains the related problem of the nature of the relationship between what are apparently two 'forms' of knowledge that is entailed in any question of transmuting 'tacit into 'explicit' (or indeed, 'explicit' into 'tacit' - see Nonaka & Takeuchi 1995: 69-70).

As a prelude to the next section, where I will outline a conceptual framework within which we can consider both 'tacit' and 'explicit' knowledge as aspects of the same 'thing', it is worth noting a remark by the much neglected American philosopher, John Dewey. In 1948 he wrote of the "basic error or mistaking of epistemological theory":

> modern epistemological theory ... makes the cognitive primary throughout the whole theory of knowledge, thereby throwing everything out of gear, beginning with knowings-knowns[1] themselves, since it closes the door to

> seeing the latter in their position and office in the ongoing of the life-undertaking and enterprise. (Dewey to Ames, 18 July 1948, in Cantril 1960: 186; see also Ratner & Altman 1964: 516).

In plainer though less accurate language, Dewey claimed that epistemologists had started with and focused on the cognitive and had neglected or lost sight of the pre-cognitive processes and the importance of practice. In so far as epistemologists have treated know-how, acquaintance knowledge, and propositional knowledge (on which they have focused) as distinct, and have yet to consider their relationship (Klein 1998) it would seem Dewey's remark holds true today.

Dewey & Bentley's framework

The framework that permits us to hold 'tacit knowledge' and 'explicit knowledge' together, and to conceptualize transformation of one to the other, was first outlined over 50 years ago, by Dewey and Arthur Bentley, a great polymath, (see Ratner 1957, 1964 for accounts of Bentley, and his collaboration with Dewey). Between 1942 and 1948 they wrote a series of philosophical papers, largely concerned with questions relating to knowledge, that were reissued in a book in 1949 (Dewey & Bentley 1949).

In the essays they sought to set out some postulates on which the study of 'knowledge' could proceed, outlined and developed parts of a new framework, and introduced proposals for a common terminology without which they felt attempts to clarify understanding of 'knowledge' would fail. Theirs was not an epistemological study, however, for as we have seen they felt that epistemology was methodologically unsound (Dewey & Bentley 1949: 293). Nor were the papers directly about 'knowledge' for early on they concluded that

> The word "knowledge", ..., is a loose name. ... We shall rate it as No. 1 on a list of "vague words" ... Only through prolonged factual inquiry, ..., can the word "knowledge" be given determinable status with respect to such questions as: (1) the range of its application to human or animal behaviors; (2) the types of its distribution between knowers, knowns, and the presumptive intermediaries; (3) the possible localizations implied for knowledge as present in space and time. (Dewey & Bentley 1949: 48).[2]

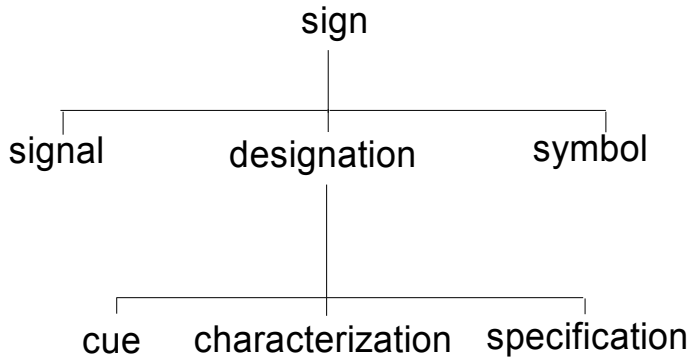
The confusion surrounding 'knowledge' in the most recent dictionary of philosophy referred to above (Klein 1998) suggests that the 'prolonged factual inquiry' Dewey and Bentley called for has not taken place, or is yet to reach firm conclusions.

Instead of examining the "vague generality" offered by the word 'knowledge', they proposed to concern themselves "directly with knowings and knowns" – things that could be observed in relation to the knowing process (Dewey and Bentley 1949:48). Their basic postulate was that "Knowings are behaviors" (Dewey and Bentley 1949: 74)[3], a word that for them indicated "the wide ranges of adaptive living ... including thereunder everything psychological and everything sociological in human beings ... the subjectmatter of behavioral inquiries involves organism and environmental objects jointly at every instance of their occurrence, and in every portion of space they occupy." (Dewey and Bentley 1949:129-30). In their private correspondence they recognized this implied an identity of behaving and knowing, and were not entirely happy with this (Ratner and Altman 1964: 126, 150, 239-41) but left it for others to

work on the relationship.

Behaviour itself was seen as necessarily entailing signing or sign-process: the presence of one implied the presence of the other (Dewey and Bentley 1949: 150). Sign was a "characteristic behavioral process" covering the entire range of "behavioral activity" from the "sensitive reactions of protozoa to the most complex symbolic procedures of mathematics" (Dewey and Bentley 1949: 71). This position, Dewey wrote, meant that their "position is a commitment to recognition of a knowing-known aspect or phase in all behavior from protozoa all the way through." (Ratner & Altman 1964: 241). In turn this meant "sign-process" held 'knowledge' in one scheme from the "perceptual-manipulative" behaviours of protozoa and of human beings to "regions of mathematical and syntactical consistency" (Dewey & Bentley 1949: 91, 299; Ratner and Altman 1964: 123).

On the basis of these preliminaries they described and developed parts of a sign-process "spectrum" covering "the bodily end to the symbolic" (Ratner and Altman 1964: 142), as follows:



This framework distinguished three "genera" of sign: "*signal*" (covering "perceptions, manipulations, habituations") or the 'perceptual-manipulative' phase, "*name*" (or alternately, *designation*) (where "organized language is employed as sign") and "*symbol*" (for mathematical regions). Within 'name' or 'designation' they further distinguished cue, characterization, and specification to mark degrees of linguistic sophistication. Cue covered grunts and similar noises; characterization was the phase of everyday language while specification marked the development of scientific terminology (Dewey and Bentley 1949: 71; Chaps. 6 & 10). They did not develop signal, or symbol. This framework thus linked together non-verbal, verbal or linguistic, and symbolising behaviour in one scheme as forms of sign-process through which life-forms 'know'.

Throughout their papers Dewey and Bentley used an evolutionary schema to describe the relationships between sign, name/designation, and symbol. As we have seen, signal was seen as characteristic of, e.g. protozoa, while designation and symbol were only found in humans (Dewey and Bentley 1949: 144, 150, 291, 292). On one occasion, however, they also referred to signalling as being found from protozoa right through to human beings (Dewey & Bentley 1949: 91) and late in the development of their arguments they wrote of to "Evolutionary stages *and contemporary levels* differentiated into signal, name, and symbol." (Dewey and Bentley 1949: 302, my italics). The notions that signalling is to be found in all life-forms, and of the contemporaneity of 'levels' or stages of sign-process allows us to hypothesize that *all*

are found in human behaviour, not just the complex sign-processes of designation (involving levels of language complexity) and symboling, but also signalling. their pre-verbal sign-process category.

On this basis I think it is evident where 'tacit' and 'explicit knowledge' could fit. Both are to be considered forms of sign-process: 'tacit knowledge' corresponds to signalling, while 'explicit knowledge' is equivalent to designation/name, and symbol. In order to develop and substantiate this hypothesis in the rest of the paper I will consider the question of the link between sign-process and behaviour; examine whether human behaviour involves non-verbal signing or whether human sign-processes have evolved beyond these forms to exclude them; and explore whether tacit knowledge can be explained in terms of non-verbal signing. Finally I will add a note on the question of the transmutability of non-verbal signs into verbal signs.

Sign-process and behaviour

Were Dewey and Bentley justified in claiming that sign-process was, in large part at least, an intrinsic feature of behaviour? Certainly they are not alone in making such a claim. Von Uexküll, a theoretical biologist writing in the first half of the 20th century, also viewed semiosis as the criterial attribute of life (Sebeok 1979: x). Neither Dewey nor Bentley appear to have been aware of von Uexküll's work and ideas. Kaplan (1964: 32) wrote that the most generally applicable discriminant of 'behaviour' as a subject-matter is 'the use of signs'. Sebeok (1981:136) using the term 'semiosis' instead of sign-process, claimed that it "is as much a critical attribute of all life as is the ability to metabolize." (see also Sebeok 1979: viii). Leach (1976), a social anthropologist, also saw communication and thus sign processes as central to human societies. It is therefore widely accepted that behaviour involves semiosis or sign-process; whether sign-process or semiosis *is* equivalent to or only part of behaviour is another matter that is not crucial to Dewey and Bentley's framework, or the current debate.

Non-verbal signing in humans

Studies of child development clearly show the importance of non-verbal signing in early life. Gesture and pointing by infants, and between adult carers and infants are important sources of language and linguistic competence (Bruner 1978, Clark 1978). Bruner (1966:10-11) also outlined a framework or spectrum of ways of knowing about the world based on his studies of child development that bears remarkable similarity to that of Dewey and Bentley but which was apparently developed without reference to them.

Bruner proposed that human beings translate their experience of the world into a model or some kind of representation in three ways – enactive, iconic, and symbolic. Enactive is learning through action, such as is involved in teaching someone to ride a bicycle. This idea seems to have attracted little attention among child development specialists, or other psychologists. Iconic representation depends on visual or other sense organs and upon summarizing images by means of which we are able to detect patterns. Kaufmann (1996) has recently reviewed research on mental images to which Bruner's term refers and proposed a model for understanding them. Symbolic representation referred to words or language. Enactive and iconic representation would appear to fit towards the signalling end of Dewey and Bentley's continuum,

and to correspond to 'tacit' knowing in the general sense, while Bruner's 'symbolic' covers Dewey and Bentley's designation/name, and perhaps also symbol. In terms of *development* from child to adult, then, there is evidence for the persistence of the non-verbal alongside the verbal or linguistic modes of signing and knowing in human beings.

Turning to adults Sebeok in various writings (e.g. 1994:7) has emphasised that human beings uniquely have two "repertoires of signs" at their disposal - the verbal, which is uniquely human and which forms an 'anthroposemiotic' system (Sebeok 1979: 38), and the non-verbal. The latter he named "zoosemiotics", to indicate components of human communication systems found elsewhere in the animal kingdom (Sebeok 1979: 36). Bateson (1968, cited in Sebeok 1979: 42) took exception to the view that in the evolution of *Homo sapiens* the non-verbal had decayed and been replaced by the verbal. He claimed that "the kinesics of men have become richer and more complex, and paralanguage has blossomed side by side with the evolution of verbal language." Thus, as Sebeok (1979: 42) himself put it, the two kinds of sign system "though they are often in performance subtly interwoven, serve ends largely different from one another."

The view that human adults communicate through a range and combination of verbal and non-verbal signs is widely supported. Studies of human communication indicate that the use of words is both preceded and accompanied by many other kinds of signal, and that this is true of everyday communicative activities. The linguist Lyons (1972) noted that in use language is accompanied by a variety of other signals ("paralinguistics") such as nods, gestures, eye-movements, as well as intonation, and Argyle (1972) surveyed a large number of non-verbal signals commonly found in human communication while Ellis and Beattie (1986: chapter 3) provided a further review. Leach (1972), a social anthropologist, argued that 'non-speech' or "meaningful action that is peripheral to speech action" (Leach 1972: 317) is highly significant for human beings, and moreover, that the distinction between speech and non-speech is an arbitrary one. Sebeok (1979: 44) cites research that indicates even human memory has two interconnected verbal and non-verbal components (see also Schooler & Engstler-Schooler 1990: 37).

'Tacit knowledge' as non-verbal signing

So far I have established that non-verbal signing is not just an evolutionary or ontogenic stage, but a vital part of all human life, running alongside and complementing, perhaps even enhancing, the verbal dimension. I now want to look at some reports of 'tacit knowledge' to see if the hypothesis that 'tacit knowing' is equivalent to non-verbal sign-process can be substantiated.

Josefson (1988) reviewed arguments for making nursing knowledge more systematic and 'scientific' which saw as a problem that nurses often cannot say how they know. She cited two stories from her own research illustrating these kinds of 'tacit knowledge' nurses had. In the first example a nurse recounted how she had felt there was something wrong with a post-operative patient. A young inexperienced doctor called on the nurse's insistence disagreed since in his opinion, according to the nurse's account, "the patient's vital signs were normal". The patient died later that day of complications "that could not have been diagnosed by an examination of his vital signs." (Josefson 1988: 27). We are not told why the 'vital signs' could not have

yielded such information. The second case involved an experienced nurse reflecting on herself as a novice, faced with violent patients. She recalled that she noticed an older woman, a nursing auxiliary, "was better able than others to induce calm in those around her". She attached herself to the woman from whom she learned a great deal although she never discussed how to deal with problematic situations with the older woman.

The second report also comes from studies in Sweden, and concerns weather forecasters who produced local forecasts for aeroplane pilots primarily by 'traditional' non-computerized methods, but who were beginning to use computerized forecasts and data (Perby 1988). From this account we learn that the meteorologists began their shift by being briefed by outgoing colleagues, which provided a "sign-post", as they expressed it, for their work (Perby 1988: 42). They then embarked on drawing a map which involved analysing and plotting information drawn from a wide range of sources, including personal observations. This they talked about as enabling them to "see signs of other changes" (Perby 1988: 42). Such maps are drawn at three hour intervals during the shift, providing a means and opportunity for continuous reflection on and updating of understanding about the weather. It also appears the meteorologists felt that such skills took a long time to learn, and that they did not know how they knew about the weather. They liased with national forecasters, and saw themselves as being "more open to look out for phenomena which may be a first sign of *changes* in the weather situation." (Perby 1988: 44).

Here we have several key ingredients of 'tacit knowledge' situations. First someone reports being able to do something without being aware of or able to say how they did it. Second, that they learned something without being able to say why, or without explicit instruction. Third, in the nursing case, this 'knowledge' is held, initially, by someone of lower status - the nurse, not the doctor; the nursing auxiliary, not the nurse. Finally, the 'knower' is an older more experienced person; 'tacit knowledge' acquisition depends on experience that comes with age.

We also have clear examples of semiotic processes, and even that the nurses and forecasters are aware that this is what they are doing, though their awareness is not an analytically sophisticated one. Thus both the nurse and the doctor read the 'vital signs', but came to different conclusions. Whether those 'vital signs' actually did not provide the nurse with her information must remain an open question - i.e. she may have read more from them than the doctor, or she may have read other signs in addition to the usual ones, but was unaware of having done so. The forecasters also explicitly talked about looking for signs, interpreting phenomena for which they are particularly attuned to look for, and so on. In all instances the non-verbal and the verbal are both present - both forms of sign-process are apparently essential to the nurses' and meteorologists' practice.

Polanyi himself also provided clear evidence to show that 'tacit knowing' can usefully be viewed as a non-verbal semiotic process. He discussed medical diagnostic practices as providing fundamental evidence for 'tacit knowing', and used this model as a basis for establishing a similarity among medical diagnosis, skill, use of sensory organs e.g. to maintain posture, and the mastery of tools (e.g. Polanyi 1961). For Sebeok and others (Sebeok 1979, 1981; Ginzberg 1980; Deely 1990; Nöth 1990:13) medical diagnosis is among the earliest recorded forms of sign-process that we have, and forms a paradigmatic case for semiosis. Other examples Polanyi provided are

also open to interpretation as examples of sign-process. The resolution of bumps or crop-marks in a field into evidence of archaeological remains (Polanyi 1961) was clearly a case of treating something as a sign - i.e. something that "conveys to a mind an idea about a thing" (Peirce 1894?), or "something that stands to somebody for some thing in some respect or capacity" (Peirce, cited in Nöth 1990:42).

Polanyi's thesis about 'tacit knowledge' rested on the idea that we perceive or notice something through noticing particulars, and then integrate those particulars into a whole (in which context the particulars were no longer noticed but subsumed, and thus only known 'tacitly') (Polanyi 1961: 128; 1968: 9-10). Leaving aside the validity of this approach as an account of perceptual processes (Cantril & Livingston, 1963 noted that four approaches were then extant) it would appear that his account implies semiosis. Thus Polanyi argued:

> The essential feature throughout is the fact that *particulars can be noticed in two different ways*. We can be aware of them uncomprehendingly, i.e. in themselves, or comprehendingly, in their participation in a comprehensive entity. In the first case we focus our attention on the isolated particulars; in the second, our attention is directed beyond them to the entity to which they contribute. (Polanyi 1961: 128 italics in the original).

The problem of noticing particulars to which Polanyi referred, and which was fundamental to his thesis of 'tacit knowledge' can readily be explained or framed in terms of Peirce's categories (see Thompson 1963; Hausman 1993). Peirce (1894?), one of the originators of modern semiotics, argued that we take "three kinds of interest" in something which correspond to three "states of mind". In the first we simply contemplate something as if "in a dreamy state". Second, we may be interested in something because of its reactions with other things as when a sudden loud noise causes an instinctive reaction. Third, we think, and are aware of learning, as when engaging in one action we find it brings about another thus discovering "a third thing which is a means to an end", in short, "a *sign*, or representation."

These 'kinds of interest' or 'states of mind' clearly relate to Peirce's three philosophical fundamental categories: firstness or quality; secondness or relation; and thirdness, or representation (Thompson 1963: 19-29; Hausman 1993: Chapter 3). Turning to Polanyi, it appears his claim involves Peirce's first and third kinds of interest. We may be aware uncomprehendingly or contemplatively of something, a 'particular'; or we may be aware of it as a sign of something else which. In the latter case the sign-process will undoubtedly occupy our attention to the detriment of the thing now taken as a sign. Like the figure-ground phenomenon, we cannot simultaneously consciously hold to something as a quality, (Peirce's first state of mind) *and* as a sign. One implication of this is that we do not *need* a notion of 'tacit knowledge' such as Polanyi's to understand how we live since it is superfluous.

Polanyi also at times discusses 'tacit knowledge' explicitly in terms of sign-process. For example he noted the experimental finding (called "subception" at the time) that subjects who were administered an electric shock after seeing a set of nonsense syllables showed symptoms of anticipating the shock when presented with the syllables, but were not aware of preparing themselves (1966a: 7-8). Later he commented "When the sight of certain syllables makes us expect an electric shock, we may say that they *signify* the approach of a shock. This is their *meaning* to us."

(1966a: 11, his italics). Thus, he argued, we attend to something (the anticipated shock) from something else (the syllables) - a clear example of semiotic process the understanding of which does not require the notion of 'tacit' knowing.

Some of Polanyi's other examples of 'tacit knowledge' are not however comprehensible in terms of sign-process. These include his claim that a cyclist turning a corner maintains his or her balance by tacitly knowing the formula relating angle of imbalance, radius of curve, and velocity (Polanyi, 1966b: 144), and his idea of 'foreknowledge'. It was on this latter basis that he claimed: "The true meaning of the heliocentric system was discovered by Newton, but it was anticipated 140 years earlier by Copernicus." (Polanyi 1961: 133). Elsewhere (Gourlay 2000) I have argued that this view is rather implausible to say the least. On basis of 'foreknowledge', for example, we must accept that the theory of relativity has been 'known' since the dawn of life since all things have to meet the conditions it states (or perhaps more intriguing, we all 'know' that Einstein was wrong, but are not telling!).

It is also worth noting there are links between 'tacit knowing', and implicit learning. The reports of 'subception' that Polanyi took as experimental confirmation of 'tacit knowing' (Polanyi 1966a: 7-8) were amongst early experimental attempts to study unconscious or tacit learning (Reber 1993: 17). Useful reviews of the state of understanding of implicit learning have been provided by Jiménez (1997) Marescaux (1997), and Stadler and Frensch (1998). It is clear from some of these reports (e.g. Marescaux 1997: 61) that implicit learning involved consciously making a number of complex observations and treating them as signs. Thus it appears that at least some implicit learning processes involve signing. The experiments with nonsense groups of letters, such as those Reber (1993: Chapter 2) has engaged in, are also open to a semiotic interpretation of the underlying processes he observed.

This discussion of non-verbal sign-process in humans could be extended, but space does not permit. For example, a wide-ranging review of research and theories in relation to non-verbal communications indicating they can all be approached as forms of sign-process or semiotics is provided by Nöth (1990). Besides, enough has been said to indicate that such processes do occur in adults as well as infants; and that it is important for the life-processes of adults. The case has thus been established for regarding 'tacit knowing' and its outcome, 'tacit knowledge' as that knowing accomplished through "perceptual-manipulative" processes. It may also accompany or be accompanied by linguistic knowing, but its relationship with "designation" (and "symboling") remains to be investigated

Conclusion

The existence and significance of non-verbal sign reading and communication is well established fact of some branches of anthropology, psychology, and social science, not to mention semiotics. It seems however to have been overlooked by dominant trends in modern cognitive and information science from which knowledge management draws much of its theoretical inspiration.

Dewey and Bentley's (1949) framework thus provides a useful conceptual tool for thinking about 'knowledge' in relation to practice. We can also conclude there is a good case for holding both as postulates subject to further examination, and as heuristic assumptions, that:

- behaviour/behaving involves sign-process, and knowing; sign-process and knowing are perhaps equivalent (i.e. alternative names for the same behavioural process)

- sign-process extends from the 'perceptual-manipulative' to the symbolic / cognitive

- human knowing involves the whole range of forms of sign-process, not just (or even primarily) those 'cognitive' or 'linguistic' regions Dewey and Bentley named 'designation' and 'symbol'

- 'explicit knowledge' clearly lies within what Dewey and Bentley called designation, and also within symbol

- 'tacit knowledge' is equivalent to Dewey and Bentley's 'signal' (and to Bruner's (1966) enactive and iconic) as pre-linguistic (i.e. pre word-based) modes of human knowing

- treating 'tacit knowledge' as that which cannot be expressed in words as non-linguistic signs (of various kinds) is:

  a) consistent with both Polanyi's and Janik's use of the term as something it is not expressed in words, and therefore (excepting that someone might use words idiosyncratically) is not in a public form. Likewise it is constrained in time and space to particular perceptual-manipulative events undergone by individuals, and their consequences for those individuals (e.g. memory), and therefore also 'personal'.

  b) different from Sternberg & Wagner who treat tacit knowledge as if like any other complex 'invisible' sociological or psychological variable, and have operationalised a means of measuring tacit knowledge.

  c) holds out the potential for more effective study, and ultimately therefore control - insofar as we treat 'tacit knowledge' as non-verbal sign-process, and investigate it accordingly. The nursing examples, for instance, could if investigated for sign-process yield evidence that the experienced nurse *was* reading signs overlooked by the doctor, while the older auxiliary was sending non-verbal signals to both patients and the nurse who learned tacitly from her. If such a study were successful, then it would be possible in some form to train others to read the relevant signs.

Notes on the question of transmutating signs

A key question for knowledge management concerns the transmutation of 'tacit knowledge' into 'explicit knowledge'. In terms drawn from the new framework - is it possible for non-verbal signs to be communicated, and, can signals be converted or transmuted into designations? Authorities on these questions are split into two groups

- optimists, and pessimists. Here there is only space to indicate some issues and ideas beginning with the pessimists.

Sebeok (1979: 38) has cast doubt on the possibility of 'transmuting' non-verbal signs into verbal ones on the grounds that animal sounds cannot be paraphrased, and that human signs like bugle calls in the army "defy comprehensible verbal definition". Janik (1988) is also a pessimist since, to cite his mentor, Wittgenstein, "practice has to speak for itself" (Wittgenstein 1969, cited in Josefson 1988: 28). That is, in the context, the knowing that comes about through doing cannot be expressed in words or, more explicitly, in the form of rules.

The pessimist case is also supported by research into the effects on visual memory of describing those memories (Schooler & Engstler-Schooler 1990). Contrary to the traditional view that visual memories can be enhanced by verbal associations with those memories Schooler and Engstler-Schooler found that verbalizing memory for the appearance of a face impaired subsequent recognition. They replicated this finding by using coloured chips instead of faces. Subsequent research has confirmed, but also modified their results. Thus if visual identification of faces is separated in time from verbal description the interference that Schooler and Engstler-Schooler described is reduced (Finger & Pezdek 1999). Other research replicated their results for faces, but not for recognition of cars (Westerman & Larsen 1997) suggesting there might be something special about face recognition making it susceptible to interference if verbalization of face characteristics occurs.

Schooler and Engstler-Schooler's discussion of their results (1990:61-4) drew attention to research which suggested the *applicability* of verbalization might mediate its effects. This seems to mean that where subjects felt the descriptions to be useful, then they did not overshadow the visual memories, and even assisted them. While the details of this effect require further investigation, it does suggest that if people have a vocabulary to refer to the visual memory (and we do not ordinarily possess a generally applicable vocabulary for facial forms and expressions) then the interference of one form of memory on the other was less or absent. This in turn suggests the findings with respect to faces may not be generalizable to attempts to transmute other non-verbal signs into words or other communicable symbols.

For the optimists the linguist Hjelmslev (1953) was cited by Sebeok (1979) as claiming that signs in one form can be 'transmuted' into those in another, though Sebeok commented that this was an "*ex cathedra* declaration" (Sebeok 1979: 38). Support for the claim, however, comes from a variety of sources. For example evidence I would consider supports the optimists' case is that humans show remarkable ability to develop new categories; to identify and share signs, and to invent words with which to refer to those signs. Almost any specialised activity has with it a specialised vocabulary that the experts in the field use to communicate with each other in and away from the practice of that field. Such words are usually extremely esoteric to the rest of us 'outsiders' who are in the position of novices. That this is a universal human characteristic is shown by anthropological and linguistic studies (e.g. Worsley 1997; Lakoff 1987). More specifically, it has recently been reported that both expert and novice wine tasters were able to communicate olfactory signs to each other and to develop a coherent set of descriptors (Chollet & Valentin 2000).

But perhaps the point is not about being able fully to express the non-verbal *fully*, but

merely to be able to express it with sufficient precision that others can be guided to identifying the non-verbal signs themselves without the need for direct communication in context with an expert. Marescaux (1997) has demonstrated experimentally that the traditional claim that implicit learning was dissociated from ability to talk about what had been learned may be a methodological artefact. He showed that subjects could not only produce verbal accounts of their actions, but that those with high quality verbal accounts performed better than others, and could transmit that 'knowledge' verbally to novices, who in turn performed better than those taught by the poorer verbalizers. They did not, however, produce *rules* for their conduct which earlier researchers had expected, but only general observations and remarks.

Finally, whether it would be cost-effective to try to isolate and categorize signs that currently are non-verbal is impossible to determine in general. This must be evaluated once it has been established that 'tacit knowledge' is important in a commercial or other organizational context. It may prove relatively easy and/or worthwhile to explicate some instances of non-verbal knowing, while other instances might be more effectively transmitted/learned through practice and interaction with experts and peers while remaining the property and under control of the people that generated it. It is, however, not impossible to communicate 'tacit knowledge'.

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1 “knowing-knowns” is a technical term developed by Dewey and Bentley (1949) the explanation of which would require too extended a discussion. *Very roughly speaking*, it is equivalent to ‘knowledge’ as behaviour (Dewey & Bentley 1949: Chapters 2-6, 11).

2 Epistemologists do not yet appear to have reached any firm conclusions despite the intervening period to judge by Klein’s (1998) account. In some respects knowledge management writers have made the position more complex. In a draft of the essay from which the above quotation is taken, Bentley wrote: “One thing, however, can be said: Whenever men apply the word, living organisms are involved also.” (Ratner and Altman 1964: 459). Knowledge management writers, however, have extended ‘knowledge’ to cover something ‘embedded’ in material goods and products (REF).

3 Dewey and Bentley were not ‘behaviourists’ as they explicitly rejected Watsonian ‘behaviourism’ - (1949: 77, 97), and their ‘transactional’ approach is also inconsistent with behaviourism.