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Abstract—The notion of tacit knowledge has been widely and diversely adopted in the knowledge management literature. It is used to cover knowledge which hasn't yet been articulated as well as knowledge which various authors argue cannot ever be articulated. This paper seeks to review these differences and proposes a conceptual means of understanding the issues associated with tacit knowledge. It draws on the work of Collins and Kusch to introduce notions of polimorphic and mimeomorphic actions before raising implications for the practice of knowledge management.

A. Introduction

The study of human knowledge has been a central subject matter of philosophy and epistemology since the Ancient Greeks. Western philosophers have often argued that knowledge is "justified true belief", a concept that was first introduced by Plato in his *Meno*, *Phaedo* and *Theaetetus* [1]. The topic of knowledge has begun to gain a new wave of attention in recent years. This is partly due to computerisation, and in particular studies into artificial intelligence and technologies to manage and maintain the knowledge found in organisations [2].

Within the literature on the management of knowledge, the concept of 'tacit knowledge' has become predominant. Nonaka and Takeuchi [1] have defined tacit knowledge as "personal knowledge embedded in individual experience and involves intangible factors such as personal belief, perspective and value system" [1, p. vii]. They contrast this to the other kind of knowledge, 'explicit knowledge', which "can be articulated in formal language including grammatical statements, mathematical expressions, specifications, manuals and so forth" [1, p. viii]. Howells [3] connects tacit knowledge more directly with the performance of skills, and defines it as "non–codified, disembodied know–how that is acquired via the informal take–up of learned behaviour and procedure" [3, p. 92]. In this reading, tacit knowledge is seen as a major barrier to the encapsulation of human knowledge in artificially intelligent machines [4] [5].

The concept of tacit knowing was (re) introduced by the scientist turned philosopher, Michael Polanyi, in the 1950s. The starting point for Polanyi's philosophical argument was the notion that "we know more than we can tell" [6, p. 4]. Since then, the term has been appropriated by other authors and 'translated' [7] to fit their own particular needs and ideas. Polanyi used it for philosophical reasoning about the nature and justification of scientific knowledge. In contrast, these other authors try to use it in more diverse and purposeful ways. This pragmatic approach to the term has resulted in considerable inconsistency and confusion in how the term is used. The purpose of this paper is to review the different ways in which the term 'tacit knowledge' has been used comparing them with the initial proposal made by Polanyi. It then proposes a new vocabulary and conceptual framework for addressing the issues of tacit and explicit knowledge which can be of benefit to the information systems and knowledge management community.

The following section will briefly illustrate the range of ways in which the term has been used, showing the increasingly diverse ways in which "knowing more than we can tell" has been interpreted. This discourse is then contrasted with Polanyi's own use of the term. The paper then draws on the distinctions made by Collins and Kusch, who present a theory of the shape of actions which helps clarify what we mean by tacit knowledge. Their theory allows us to integrate Polanyi's initial ideas with the more recent examples found in the knowledge management literature.

B. Tacit knowledge in the knowledge management literature

In many instances, the literature on knowledge management is particularly vague about what is meant by tacit knowledge, drawing instead on some of the attributes which might shape it. In so doing it is typically contrasted with explicit knowledge which can be readily coded for manipulation by computer based systems. For example, Grant and Gregory [8] suggest that knowledge is tacit if it is embedded in the context of an individual's skill *or* it involves high speed and simultaneous information processing, which cannot be slowed down or practised slowly *or* it involves the recognition of wholes (gestalts) which relies on the awareness of diffuse, subsidiary clues *or* the complex nature of the skill is lost in language,

which cannot serve to describe relationships and characterise the entities related [8, p. 153].

Explicit knowledge, therefore does not rely on wholes, is not lost in language and can be performed at a relatively slow speed.

In contrast, Hutchins [9] suggests that many of these attributes of knowledge are not found solely in individuals, but rather are distributed through a social workgroup, which works together (and with technical artifacts) to undertake the kinds of activities described by Grant and Gregory. Tacitness, then, is enabled by the group (more accurately, the socio–technical imbroglio) rather than the individual.

Another description of tacit knowledge is presented by Zander and Zander (in [3]) who assert that tacit know–how is articulable under certain circumstances: when the pace of performance is slow and pace variations are tolerable, when a standardised, controlled context for the performance is assured, and when the performance as a whole can be simplified to basic interactions.

Even when there is general agreement that tacit knowledge is knowledge that resides "in the heads" of people, there are still different interpretations of why that knowledge must reside there. The two extremes on this debate are found in the 'difficulty' and the 'de facto' schools. Scholars belonging to the dominant difficulty school argue that tacit knowledge is *difficult* (but not in theory impossible) to articulate and formalise. Knowledge that does not face this difficulty is (or could be) articulated, formalised and codified. Thus, Zander and Zander suggest the conditions under which tacit knowledge could be made explicit, arguing that it is difficult to make tacit knowledge explicit when it is found in a varied context and where the performance whole is not decomposable.

Hansen *et al.* [10] make much the same point "(E)xplicit knowledge is knowledge that can be codified" and "(T)acit knowledge ... is difficult to articulate in writing and is acquired through personal experience" [10, p. 115]. They then use this distinction to provide advice on how to manage knowledge in the organisation: if much of the knowledge in an organisation is tacit then they suggest that it is not worth trying to make it explicit and the organisation should instead enable all parts of the organisation to have access to the experts with the tacit knowledge.

Some other examples of the difficulty school include Fleck [11] who says that tacit knowledge is "not ... readily articulable and therefore not easily communicable or tradable" [11, p. 388]. Howells [3] similarly maintains that tacit knowledge is "difficult to codify, standardise and transfer" [3, p. 103] and "not easily embodied in a blueprint or operating manual" [3, p. 97]. Nonaka and Takeuchi [1] state similarly that tacit knowledge is "hard to formalise and communicate to others" [1, p. 238]. They maintain, however, that tacit knowledge *can* be articulated most of the time, although sometimes this is done through the use of metaphors rather than directly.

In contrast, the *de facto* school equates tacit knowledge with uncodified knowledge and opposes it to codified knowledge [12][13]. Boisot [13] asserts that "the issue is one of choosing which items to make tacit and which to ones to codify" [13, p. 492] suggesting that the problem is not one of difficultly, but rather is simply one of choice of where to focus attention. Alavi and Leidner [14] hold a similar view and argue that knowledge becomes tacit once it is processed in the mind of an individual, and that this tacit knowledge becomes explicit again "once it is communicated to others in the form of text, computer output, spoken or written words, or other means" [14, p. 6].

Dutta and Weiss [15] state that "(C)odified knowledge is amenable to the printed page and can easily be transmitted, such as in designs and specifications, and is therefore less proprietary than tacit knowledge, which is far more difficult to codify and hence difficult to imitate" [15, p. 345]. They thus make an important clarification for the *de facto* school, namely that codified knowledge is equivalent to explicit knowledge.

The very different uses of the term can now be seen and, whilst there is no inherent problem with a diverse vocabulary for describing these phenomena, at times terminological flexibility does lead to more problems than it resolves. The first use of the term tacit knowledge is associated with knowledge that has not yet been formalised. Thus tacit knowledge is a subset of all knowledge consisting of those items that have not (yet) been made explicit. A second use of the term is associated with knowledge which cannot be formalised. There are two sub–categories here. The first argues that some knowledge cannot be formalised because the knowledge is embodied. The second argues that it cannot be formalised because of fundamental characteristics of the nature of the knowledge. A further suggestion is that some human abilities are simply beyond our knowledge. However, this paper would suggest that rather than being unknowable they are simply of a form that is not amenable to expression using our conventional, reductionistic forms and hence are subsumed under the second sub–category. Table 1 shows these different forms.

Type of tacit knowledge	Typical reason
Knowledge that has **not yet** been formalised	Because of cost / time limitations
Knowledge that **cannot** be formalised	Because it is embodied
	Because of the form of the knowledge

Table 1: Different types of tacit knowledge

Creating such a table carries with it the risk of grossly oversimplifying the situation. Is the reason why the knowledge has not yet been formalised because, in fact, it relies on embodied skills or uses a form of knowledge that cannot be formalised? Similarly, is it accurate to really say that knowledge cannot be formalised because it is embodied, or is it simply the case that it has not yet been formalised because our tools and means of representation are not particularly suited to embodied knowledge. This notion is supported by Nelson and Winter [16] who state that "(w)hether a particular bit of knowledge is *in principle* articulable or necessarily tacit is not the relevant question in most behavioral situations. Rather, the question is whether the costs associated with the obstacles to articulation are sufficiently high so that the knowledge *in fact* remains tacit" [16, p. 82]. The third situation, namely that there are forms of knowledge that *cannot* be formalised and articulated will be supported below.

In order to try and clarify this situation, it might be helpful to first return to Polanyi's original ideas to see how he used the term tacit knowledge, before seeing how other authors have addressed the question of what knowledge can and cannot be made explicit.

C. Tacit knowledge according to Polanyi

Michael Polanyi argues from a philosophical point of view, and enquires into the nature and justification of scientific knowledge. The central point of Polanyi's argument is, as has been mentioned, that "we know more than we can tell" [6, p.4]. In the light of the previous discussion, however, it would be useful to try and understand what kinds of things Polanyi thought we couldn't tell and what he felt were the reasons for this inability.

Perhaps his most famous example of tacit knowledge is the ability to ride a bicycle [17]. This is an interesting example because it combines the different categories described in table 1. "If I know how to ride a bicycle..., this does not mean that I can tell how I manage to keep my balance on a bicycle... . I may not have the slightest idea of how I do this, or even an entirely wrong or grossly imperfect idea of it, and yet go on cycling ... merrily. Nor can it be said that I know how to bicycle... and yet do *not* know how to co–ordinate the complex pattern of muscular acts by which I do my cycling... . I both know how to carry out (this performance) as a whole and also know how to carry out the elementary acts which constitute (it), although I cannot tell what these acts are" [18, p. 4].

It is hardly surprising, then, that the knowledge management literature is so confused. In this short extract, Polanyi has shown how the knowledge involved in riding a bicycle has not been made explicit, involves an embodied skill and cannot easily be articulated. He adds to the confusion when he states: "(I)n order to compensate for a given angle of imbalance (α) we must take a curve on the side of the imbalance, of which the radius (r) should be proportionate to the square of the velocity (v) over the imbalance $r \sim v^2/\alpha$" [18, pp. 6–7], thus suggesting that riding a bike whilst tacit in his understanding, could consist of explicit knowledge.

However, he argues, such knowledge is ineffectual, unless known tacitly. We cannot learn how to keep our balances on a bicycle solely by studying this formula. It does not even help us in the slightest, unless we were building a bike–balancing robot. "Tacit knowing is the fundamental power of the mind which creates explicit knowing, lends meaning to it and controls its uses" [18, p. 18].

He argues that a sharp division between tacit and explicit ("capable of being clearly stated" [18, p. 16]) knowledge does not exist. "Tacit thought forms an indispensable part of all knowledge" [19, p.20]. Even if knowledge has been articulated into words or mathematical formulas, this explicit knowledge must rely on being tacitly understood and applied. Hence "all knowledge is *either tacit* or *rooted in tacit knowledge*" [18, p. 7 emphasis in original]. A wholly explicit knowledge, he argues, is unthinkable. "(A) mathematical theory can ... function as a theory only within an act of tacit knowing" [19, p. 21]. In so doing, he emphasises the "knower's active participation in any act of knowing" [18, p. 4].

Thus, if the knowledge management literature were to stay true to Polanyi, then it would have to acknowledge the fundamental role that tacit knowledge plays in all human knowledge–based activity. In order to deal with this background understanding which is needed to make sense of any knowledge, we need an explanation of why we can, in operational situations, ignore many of the issues associated with it. In the same way that we assume a certain level of literacy when writing computer manuals, so we can be indifferent to a certain level of tacit knowledge that is required to enable us to use any form of more explicit knowledge. In the next section, a new way of studying the shape of actions is introduced which specifically deals with this area of indifference.

D. The shape of actions

A recent theoretical attempt to understand what is meant by tacit knowledge is provided by Collins and Kusch [20] who describe what they call "the shape of actions" which provides a categorisation of actions which can, in principle, be made explicit and hence performed by machines, and those which remain entirely within the realm of humans. They do this by distinguishing between polimorphic and mimeomorphic actions.

They use the term action in contrast to behaviour, where behaviours are "any sequence of bodily movements" [20, p. 31]. Actions are always associated in one way or another with intentions: action = behaviour+intention. Given this intentional element, it is reasonable to assume, therefore, that there is a direct link between knowledge and the action it is associated with.

Mimeomorphic actions are then actions which we "either seek to or are content to carry out in pretty much the same way, in terms of behaviour, on different occasions" [20, p. 31]. An example of a mimeomorphic action is switching on a light. We are behaviourally indifferent to how this action is performed, in that we do not care whether this action is performed with our right or left hand, with quick or slow movements, and so forth. Thus, the (in Polanyi's terms) background tacit knowledge needed to be able to perform this action is not important. We can therefore define mimeomorphic knowledge as that knowledge which is needed to successfully perform such actions.

Polimorphic actions are characterised by the fact that they usually involve varying behaviour to carry out the same action in relation to a situation. This is due to the fact that a polimorphic action "takes its shape from society" [20, p. 37]. An example of a polimorphic action is telling a joke. We expect to perform this action differently on each occasion, since in performing the action we have to interact with the society in which the action is embedded. We are therefore *not* behaviourally indifferent to how this action is performed and the knowledge required to successfully perform the action can therefore be labelled as polimorphic knowledge. There is a direct link here to Wittgenstein's ideas of language [21] [22], ideas which have shaped much of Collins' earlier work (see, for example, [23]).

This can be shown diagrammatically. Figure 1 shows how a particular action can be implemented through various behaviours. We need to choose which behaviour to use and the appropriateness of the choice depends on the society we are dealing with.

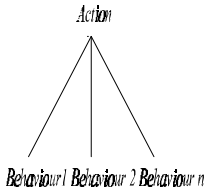

Figure 1 Polimorphic action

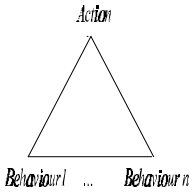

Figure 2 Mimeomorphic action

With mimeomorphic actions, we are indifferent as to which behaviour is used, although the range of possible behaviours will vary from situation to situation, see figure 2.

The crucial point in their argument is that polimorphic actions cannot, as a matter of principle, be learned except through socialisation or apprenticeship; through "embedding within society" [20, p. 88]. "To learn how to interact with a society, one has to interact with that very society" [20, p. 88].

Mimeomorphic actions, in contrast, can be learned in other ways. The formula for a mimeomorphic action, provided it is not impossibly complex, can be "inscribed in temporarily decontextualised form, and is therefore transferable in a more straightforward way" [20, p. 86].

However, if a mimeomorphic action is complex, it is also (like a polimorphic action) most easily transferred through socialisation or apprenticeship, because this is a way in which humans have become adept at learning complex skills. This means that it is often difficult to determine whether an action (and the knowledge that underlies it) is polimorphic or mimeomorphic by observing how it is learned.

E. Tacit knowledge and polimorphic knowledge

The distinction that Collins and Kusch make, can be usefully illustrated by reconsidering the example of bike riding that Polanyi introduced.

Riding a bicycle without interaction with traffic Collins and Kusch call "bike balancing". Bike balancing is a mimeomorphic action because we are behaviourally indifferent to how the action is carried out. However, "(e)ven if the formula for bike balancing is already known to engineers, our brains are not fast enough to cope with learning to bike balance by applying the formula" [20, p. 87]. Learning how to bike balance is therefore achieved through learning by doing, on a bicycle, in the "real world".

Riding a bicycle through traffic, on the other hand, is a polimorphic action because in performing the action we have to interact with the society in which it is embedded, and because we therefore are *not* behaviourally indifferent to how the action is performed. This can be easily verified by trying to ride a bike in a country one is not familiar with.

Even if "bike balancing" and "riding a bicycle through traffic" are both learned in essentially the same way (socialisation/apprenticeship; learning by doing, in the "real world"), there is however, Collins and Kusch argue, a *principled* difference between how these different actions. They explain: "(W)e could build a bike balancing simulator—something like an aircraft simulator—and learn to balance a bike without ever having sat on one. It just happens that no one thinks this a worthwhile thing to do" [20, p. 86]. If this were done, however, this would mean that "bike balancing" could be learned without embedding within society, the "real world".

In contrast, polimorphic actions, Collins and Kusch argue, *cannot*, as a matter of principle, be learned without embedding within society, because "societies cannot be simulated" [20, p. 86] (for more on this, see Collins [24], especially chapters 13 and 14). Advice and instructions may aid the mastery of polimorphic actions, but the advice cannot replace experience. "For a set of instructions covering a polimorphic action to be so

complete that it could not be misunderstood by an unsocialised entity, it would need to anticipate all the social circumstances with which the skilled practitioner must operate" [20, p. 86]. It is important to emphasise that the behaviours associated with polimorphic actions can still be performed without this socialisation: it is possible to tell a joke at a funeral and it is also possible for this to be, by chance, the most appropriate thing to do. This does not make it a polimorphic action.

F. Conclusions

This paper has shown that knowledge management literature uses the term "tacit knowledge" in an inconsistent and confused way. The concept is defined in broad terms, and the attributes that various scholars attach to it show that their perceptions of the concept often are contradictory. The knowledge management literature's use of the term can essentially be divided in two different "schools": the "difficulty school" and the "*de facto* school." Some authors maintain that tacit knowledge is knowledge that is *difficult* to articulate or formalise, while others seem to suggest that *all* knowledge is tacit, as long as it has not yet *de facto* been articulated/formalised. This ambivalence is reflected in other terminology within the theoretical framework in which tacit knowledge is situated. Explicit knowledge—all knowledge that is not tacit—is predominantly thought of as knowledge that is possible (or "easy") to articulate or formalise. Some authors use the term "codified knowledge" instead of "explicit knowledge" for all knowledge that is not tacit. Some of these scholars equate codified knowledge with knowledge that *de facto* has been articulated/written down (in accordance with the "*de facto* school"), while others refer to it as knowledge that is "amenable to the written page," or codifiable (in accordance with the "difficulty school").

This review has shown that knowledge management scholars have, in applying the tacit knowledge concept to their particular area of research, sometimes taken advantage of the nebulosity of the concept to stretch it in ways that are advantageous to them. One streak the knowledge management scholars do have in common, however, is that they seek to draw a clear dividing line between tacit and explicit knowledge. This means that the knowledge management literature's perception of "tacit knowledge" does not fully correspond to Polanyi's. Polanyi's philosophical argument was that tacit knowing is an indispensable part of all knowledge, and that making a sharp division between tacit and explicit knowledge is not possible, or meaningful. The fact that knowledge management scholars, in using the term tacit knowledge actually distance themselves from Polanyi's use of the term (tacit knowing) is not recognised in the literature.

Collins and Kusch help address this point by introducing the notion of behavioral indifference whereby a certain level of tacit knowing can be accepted, without having an impact on the wider question of what is tacit and what is explicit. The paper introduced their distinction between polimorphic and mimeomorphic actions to see whether it could be used to clarify the tacit/explicit distinction and introduce a criteria for differentiating between different types of knowledge. The polimorphic / mimeomorphic distinction was shown to be particularly applicable in discussions addressing what knowledge / skills that could / should be captured in machines, in order to replace human skills. When discussing the human–to–human transfer of skills, however, it is often the case that polimorphic and complex mimeomorphic skills are transferred in the same way, since in both cases human mastery rests upon tacit knowledge.

Thus the shape of actions allows us to make clear theoretical distinctions between different kinds of actions, which embody knowledge which has been described as tacit and that which has been described as explicit. Given the complex, interrelated nature of all human activities, empirical studies will be needed to determine the extent to which particular organisational actions are classifiable as either polimorphic and mimeomorphic actions. One possible solution would be to draw on Callon's analysis of the role of market forces [25] as a mechanism for circumscribing different kinds of activity in complex situations and allowing organisations to differentiate between the knowledge and skills that are easily traded in the open labour market, with that knowledge and skills which is specific to the organisational culture of the firm and provides a source of competitive advantage.

Despite this inherent complexity of the human condition, this analysis helps in understanding the different kinds of knowledge and actions found in organisations. From this it is feasible to determine the kinds of support and control needed by different parts of the organisation [26]: thus the work of an computer support technician requires different kinds of support from that of a personal assistant to the managing director.

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References

[1] Nonaka, I. and H. Takeuchi, *The knowledge creating company: How Japanese companies create the dynamics of innovation*. 1995, New York: Oxford University Press.

[2] Whitley, E.A., *Two approaches to developing expert systems: A consideration of formal and semi–formal domains.* AI & Society, 1991. **5**(2): p. 110–127.

[3] Howells, J., *Tacit Knowledge, Innovation and Technology Transfer.* Technology Analysis & Strategic Management, 1996. **8**(2): p. 92–106.

[4] MacKenzie, D., *Knowing machines: Essays on technical change*. 1996, Cambridge, MA: The MIT Press.

[5] Cooley, M., *Architect or bee? The human price of technology*. New, extended edition ed. 1987, London: Tigerstripe.

[6] Polanyi, M., *The tacit dimension*. 1966, Gloucester, MA: Peter Smith.

[7] Latour, B., *Science in action: How to follow scientists and engineers through society*. 1987, Cambridge, MA: Harvard University Press.

[8] Grant, E. and M. Gregory, *Tacit Knowledge, the Life Cykle and International Manufacturing Transfer.* Technology Analysis & Strategic Management, 1997. **9**(2): p. 149–161.

[9] Hutchins, E., *Cognition in the wild*. 1995, Cambridge, MA: The MIT Press.

[10] Hansen, M.T., N. Nohria, and T. Tierney, *What's your strategy for managing knowledge.* Harvard Business Review, 1999(March–April): p. 106–116.

[11] Fleck, J., *Contingent Knowledge and Technology Development.* Technology analysis & Strategic management, 1997. **9**(4): p. 383–398.

[12] Teece, D., *The Market for Know–How and the Efficient International Transfer of Technology.* AAPSS, 1981. **458**: p. 81–96.

[13] Boisot, M., *Is Your Firm a Creative Destroyer? Competitive Learning and Knowledge Flows in the Technological Strategies of Firms.* Research policy, 1995. **24**: p. 489–506.

[14] Alavi, M. and D. Leidner, *Knowledge Management Systems: Issues, Challenges, and Benefits.* Communications of the Association for Information Systems, 1999. **1**: p. Article 7.

[15] Dutta, S., *The Relationship Between a Firm's Level of Technical Innovativeness and Its Pattern of Partnership Agreements.* Management science, 1997. **43**(3): p. 343–356

[16] Nelson, R.R. and S.G. Winter, *An Evolutionary Theory of Economical Change.* 1982, London: Harvard University Press.

[17] Dreyfus, H.L. and S.E. Dreyfus, *Mind over machine: The power of human intuition and expertise in the era of the computer*. Paperback edition, with Tom Athanasiou ed. 1986, New York: The Free Press.

[18] Polanyi, M., *The Logic of Tacit Inference.* Philosophy, 1966. **41**(1): p. 1–18.

[19] Polanyi, M., *Personal Knowledge: Towards a Post–Critical Philosophy*. 1958, London: Routledge & Kegan Paul.

[20] Collins, H. and M. Kusch, *The shape of actions: What humans and machines can do*. 1998, Cambridge, MA: The MIT Press.

[21] Wittgenstein, L., *Philosophical investigations*. 1956, Oxford: Basil Blackwell.

[22] Wittgenstein, L., *Tractatus logico–philosophicus*. 1922, London: Routledge.

[23] Collins, H.M., *Changing order: Replication and induction in scientific practice*. With a new afterword ed. 1992, Chicago: University of Chicago Press.

[24] Collins, H.M., *Artificial experts: Social knowledge and intelligent machines*. 1990, Cambridge, MA: The MIT press.

[25] Callon, M., ed. *The laws of the markets*. . 1998, Blackwell: Oxford.

[26] Whitley, E.A. *Tacit and explicit knowledge: Conceptual confusion around the commodification of knowledge*. in *Knowledge management: Concepts and controversies*. 2000. Warwick: BPRC.