TECHNOLOGICAL FRAMES AND LANGUAGE-GAMES: UNDERSTANDING TACIT KNOWING

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Introduction

Tacit knowing (Polanyi, 1983), also called tacit knowledge, is a form of knowing that shapes our interpretations of and actions in the world but which at the same time is hard to describe to other people. In this paper I outline some of the knowledge and communication issues that can arise when groups with different forms of tacit knowing interact in the process of digital library development and implementation. I am interested in exploring whether these groups should arrive at a common understanding in order to proceed - and if not, what level of agreement is necessary - and, finally, how agreement of any kind can be constructed when tacit knowing is not directly articulated in discourse.

Theorizing Tacit Knowing: Technological Frames

Broadly defined, tacit knowing consists of the knowledge we have of how to do something in a learned, coordinated fashion, without paying specific attention to the individual components of the task itself. It is a coordinated, gestalt way of understanding how to *do* something, rather than a description of the components *of* that something; think here of the differences between action and description in such cases as riding a bicycle, driving a car, performing a piece of music - or using a digital library. Tacit knowing has recently been theorized by organizational theorists as tacit knowledge, and placed in opposition to explicit knowledge (see e.g. Nonaka & Takeuchi, 1995).

Tacit knowing can include assumptions regarding the functionalities of technologies; that is, some of our understandings of what a technology does may be tacit. These understandings do not have to reflect actual functionalities. While we can become familiar with a technology over time, when we are faced with a new technology we often have to guess its capabilities, projecting from our understanding(s) of similar existing technologies. Often, this strategy works (a recumbent bike functions much like a road bike, for instance, despite looking very different). Sometimes however new technologies that appear to replicate existing technologies (for instance in the way that cell phones appear to work in the same way as land-line phones) may function in different technological ways, in which case applying existing understandings to new technologies can be confusing.

Tacit knowing can also include assumptions regarding the social and political uses of a technology. For instance, studies of groupware implementation have described how technology implementers can see groupware as creating new work practices, boosting productivity, and decreasing stress amongst users, while the users can see groupware as adversely affecting productivity and increasing stress, often because the introduction of the groupware can involve the structuring of existing work practices and social structures, accompanied at the same time by a steep learning curve.

Given that users' tacit knowing is both constituted by and constitutive of the local practices of users, it is not surprising that technology implementation can be a far more complicated and contingent process than developers account for. In practice we continually improvise, adapt and repurpose technologies in novel ways to achieve our aims (Suchman, 1987). This dimension of user behaviour has been known and theorized about for a while, and I have found particularly useful here Orlikowski and Gash's (1994) model of 'technological frames' which asserts that

> people have to make sense of [technology]; and in this sense-making process, they develop particular assumptions, expectations, and knowledge of the technology, which then serve to shape subsequent actions toward it. While these interpretations become taken-for-granted and are rarely brought to the surface and reflected on, they nevertheless remain significant in influencing how actors in organizations think about and act toward technology.

These taken-for-granted interpretations are 'frames of reference,' 'built-up repertoire[s] of tacit knowledge that [are] used to impose structure upon, and impart meaning to, otherwise ambiguous social and situational information to facilitate understanding.' In relation to technology use, technological frames are thus 'the assumptions, expectations, and knowledge [organizational members] use to understand technology in organizations [including] not only the nature and the role of the technology itself, but the specific conditions, applications, and consequences of that technology in particular contexts.' Where multiple technological frames exist among different groups in the same setting and these frames differ significantly, 'organizations are

likely to experience difficulties and conflicts around developing … and using technologies.' Such difficulties and conflicts have been reported by Orlikowski and Gash for instance in the case of the introduction of LotusNotes into a large corporation.[1]

Identifying Tacit Knowing: Centering Resonance Analysis

Researchers such as Orlokowski and Gash use ethnographic data to identify tacit knowing. I also use ethnography, augmented with the recording and transcription of naturally occurring conversation and the archiving of electronic communication, and the machine analysis of these data. This method has several advantages. First, I have reviewed field notes in the light of recordings and realized how much I had missed or misinterpreted in the notes; second, digital recorders now permit clear sound recordings which can be digitally archived and sent over the Internet for quick transcription; third, much organizational communication now occurs on bulletin boards and in e-mail; and finally, this method can significantly increase the *amount* of data collected and processed. In the case of research with the Digital Water Education Library (DWEL) I recorded and transcribed workshops, meetings, and telephone conferences; archived e-mail exchanges and bulletin boards; and collected project documents (Khoo 2004, 2005).

To analyse these data I have been working with Centering Resonance Analysis (CRA; Corman et al., 2002), a computational tool that assumes that semantic meaning in discourse is centered in noun phrases, and that meaning can thus be mapped by measuring and quantifying the frequency, distribution and clustering of noun phrases within discourse. CRA generates spreadsheets and .gifs of noun frequency and distribution that point to the underlying semantic content of texts, and which can be used to identify differences in the discourse of various groups.

However, if tacit knowing is not directly represented in discourse, how may it be identified through a computational analysis of the same discourse? To answer this question I have to turn to the CRA results of my research with the DWEL project, which revealed that two of the groups in the project – the project PIs, and a group of educators – used distinct, non-overlapping vocabularies when they talked about digital libraries. The project PIs, who had a relatively large

amount of digital library knowledge, talked about various digital library system components and architectures, while the educators, who had a relatively small amount of digital library knowledge, talked about digital libraries as 'black boxes' used in the classroom.

What is notable about these differences is that while they were expected before the project began, and while they were addressed at the start of the project in three days of workshops intended to address and bridge them, *they persisted after the workshops, even when the PIs were under the impression that the differences had been resolved and the educators had acquired an understanding of digital library systems.*[2] In other words, the PIs thought that they and the educators had reached agreement, when in fact they continued to disagree.

This observation finding reflects Banks and Riley's (1993) case study of discussions on management practices between American and Japanese managers of a multinational corporation, in which the managers continued to make culturally specific assertions even when they appeared to be in agreement. Banks and Riley hypothesized that both groups of managers had tacit, cultural models of management that they were either unwilling or unable to abandon in discussion. In the case of the DWEL project therefore, I argue, similar tacit and cultural differences were present, this time between the PIs and the educators, even when they two groups were under the impression that they were in agreement. This suggests in turn that tacit knowing may well be expressed in discourse; however this will be in a form that is transparent and unapparent to the speakers.

Addressing Differences in Tacit Knowing: Language-Games and Boundary Objects

In such circumstances, how may different forms of tacit knowing be mediated and organizational members brought 'to the same page'? Organizational communication researchers often recommend 'more' and 'better' communication as means of bridging the ground between different groups and knowledges. However, what this communication might consist of is often not detailed; and also ignored is the fact, noted above, that tacit knowing in itself may not be easily rendered in communicative terms.

Another problem here is that some theorists of tacit knowledge – such as Wittgenstein (2001) ('language-games' and 'forms of life'), Giddens (1984) ('practical consciousness'), and Ehn (1988) ('language-games') - hold that different forms of tacit knowing may on occasion also be *incommensurate* (Kuhn, 1970). From this point of view different forms of tacit knowing may

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[1] Similar phenomena from a range of theoretical perspectives have been reported by range of other researchers including Barley (1986), Bijker (1995), Heracleous and Barrett (2001), and Bowker and Star (1999). I have found Orlikowski and Gash's concept of the technological frame to be particularly useful, both as a lens for analysis, and also for presenting the results of analyses to outside parties, who seem to find the technological frame concept easy to apprehend.

[2] The PIs were in fact surprised by the gaps in vocabulary between them and the educators later demonstrated by the CRA.

frame (measure) the same concept in irreconcilable ways. If this is the case how may groups with different forms of tacit knowing work together?

To briefly address (although not to resolve) this issue, I introduce here Wittgenstein's concept of language-games. Wittgenstein's terminology should not be confused with ordinary definitions of 'language' and 'game'. By *language*, he refers to practices that describe and make sense of the world (in this sense his definition of 'language' approaches a cultural one; c.f. Geertz, 1973).[3] By *game* Wittgenstein refers not to formal rule-based games such as chess or football, but to playful, creative and improvised activities, such as children's games, or a solo game of throwing a ball against a wall. Language-games can therefore be thought of as improvised yet persistent sets of interpretative cultural practices produced, reproduced, and mediated through communication and other practices.

While two groups may appear to an observer to be playing the same language-game, Wittgenstein argues that these groups need not necessarily understand that language-game in the same way. He provides the example of two groups of children playing a game of trains. The first group knows what a train is, while the second does not; but the second group can copy the first and *appear* as if they are playing at trains. From the standpoint of this position paper, two groups with different technological frames can appear to an observer to be working with the same technology, while at the same understanding it in radically different and perhaps incommensurate ways.

How may the differences between two groups and their language-games be addressed? Giddens (1984), citing Wittgenstein, argues that because all groups practice language-games, they are therefore aware at some level of what language-games are, and can in principle construct new language-games between them. Ehn (1988) echoes this idea in his theory of work-oriented technology design, in which he suggests that the differences between developers' and users' language-games can be addressed through these two groups working together on the construction of a new language-game of design-and-use. In other words the parties concerned have to become reflexively aware that (a) they are playing language-games, (b) others may have different language-games, and (c) that they have to locate and articulate both their own and also new language-games in order to play with others.

How does one learn to articulate one's own language-game, especially the tacit dimensions of that game?

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[3] Wittgenstein also at times associates language-games with 'forms of life,' which again can be taken as a reference to cultural practice.

Wittgenstein refers elsewhere to the process of 'reminding,' that is, of an *active* effort to remind oneself of what one already knows tacitly (and here again his use of 'reminding' suggests that one may possess tacit knowing that one has *forgotten* how to articulate).

How may this active reminding be encouraged? Giddens (1984) refers to a similar process in terms of encouraging one's research subjects to become social scientists who then become aware of their reflexively situated positions. This suggests that training one's research subjects in the use of the tools for eliciting the knowledge of research subjects - rather than just making them the subjects of those tools - may in turn pay dividends (in other words, the tools should be applied by the subjects to themselves, rather than by the researcher to the subjects). In the case of the DWEL project, for instance, in order to surface their own tacit knowing, the project PIs engaged in the design of a series of concept maps - graphical illustrations of knowledge domains in which the nodes represent concepts and the edges semantic relationships between those concepts (Novak, 1998) - that represented the project both to the educators but also to themselves (see Khoo 2004, 2005 for further details). Supporting a creative reflexivity on the part of DWEL developers helped therefore to 'remind' them of what they tacitly knew, and also helped them to mediate their understandings of digital libraries to the educators; and mediating these understandings resulted in turn in improved project communication and productivity.

Summary

Different groups involved in the development and implementation of digital libraries may have different tacit understandings of digital library technologies. These differences can negatively digital library project organizational communication and processes. A communication-based ethnographic approach based on

- the digital archiving and analysis of organizational communication;

- a theoretical analysis including technological frames and language-games; and

- interventions based on helping various groups to remind themselves of what it is they tacitly know

can help in identifying, unraveling and addressing some of the different forms of tacit knowing to be found amongst the various groups involved in digital library projects.

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