

SOCIAL COMPUTING FOR KNOWLEDGE CREATION – THE ROLE OF TACIT KNOWLEDGE

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Abstract

To advance understanding on knowledge creation through social computing, we posed two research questions: What are the processes underlying knowledge creation online? What is the role of tacit knowledge in online communication? We note that even if the online environment is beset with apparent limitations due to physical distance, tacit knowledge is by no means absent. It enables individuals to communicate with others and to build new knowledge through interpreting and reflecting the available information. On the collective level, tacit knowledge is demonstrated as the shared language and understanding of the members, and the norms of interaction.

Keywords: social computing, online communication, community, knowledge creation, tacit knowledge

1 INTRODUCTION

As knowledge has become the primary competitive asset for all types of organizations, understanding knowledge-related processes has become a key item on the agendas of both researchers and practicing managers. The increasingly turbulent operating environment means that, in addition to exploiting their existing knowledge assets, organizations have to be able to continuously explore new sources of success and create new knowledge (Nonaka, 1991; Leonard-Barton, 1995; Grant, 1996; Teece et al., 1997). Knowledge-creation processes are the basis for organizational learning and sustained innovativeness (Nonaka, 1994; Nonaka & Takeuchi, 1995).

Knowledge creation is essentially a social activity: knowledge is typically created, enriched, shared and leveraged in social communities, in interaction among several people (Lave & Wenger, 1991; Brown & Duguid, 1991; Nonaka and Takeuchi 1995; Nahapiet and Ghoshal 1998). A recent trend is that social communities are becoming ‘virtual’ to an increasing degree, and more and more knowledge-creation activities take place online. Novel communication technologies are opening up new possibilities for knowledge creation among organizationally and geographically dispersed individuals, and harness their collective wisdom by facilitating interaction (Sharpton & Jhaveri, 2006; Ridings et al., 2002; Wasko & Faraj, 2000). In particular, *social computing* seems to offer fruitful avenues for collaborative knowledge creation. This refers to forms of online communication that focus on social interaction and relations between people, not simply on managing information. Social-computing applications, such as weblogs, instant messengers and discussion forums, support either synchronous (real-time) or asynchronous mutual interaction among groups of people, allow the giving and receiving of feedback, facilitate status and reputation building, and maintain networks of social relationships.

Despite the proliferation of such technologies, the effects of social computing on organizations remain an understudied field. This may be due to the novelty of its organizational adoption and use. At the same time, communication technologies tend to be assessed solely in terms of their ability to mediate codified knowledge (i.e., information). For instance, Vaccaro et al. (2008) note how current literature on information systems (IS) and innovation management associate the role of virtual technologies solely with explicit knowledge processes. Whereas tacit and explicit knowledge in general are mutually constitutive and complementary (Polanyi, 1962; Tsoukas, 1994), within the online environment explicit knowledge is considered to substitute tacit knowing (see e.g., Johnson et al., 2002; Hemetsberger & Reinhardt, 2004; Lee & Cole, 2003).

Current research has largely neglected the issue of social computing, and studies systematically linking it with knowledge creation still seem to be lacking. At this point, we make the basic assumption that the knowledge processes related to social computing are somehow different than those related to knowledge-management systems and databases, and hence deserve further investigation. Our aim is to shed light on some controversies characterizing the current literature on knowledge and online communication, and to illustrate the processes that may enable knowledge creation online. In order to advance understanding of this emerging phenomenon, we therefore posed two research questions: **What are the processes underlying knowledge creation online? What is the role of tacit knowledge in online communication?** Our methodological approach was to conduct an analytical literature review within the fields of knowledge creation, learning, computer-

mediated communication, and virtual communities, in which communication is supported by social-computing technologies as a matter of course. Noting the lack of studies on social computing in the context of knowledge creation, we considered research on virtual communities a valid point of departure – communities are the context in which knowledge creation takes place (Nonaka & Konno, 1998; Sawhney & Prandelli, 2000).

This paper is organized as follows. We first construct an understanding of the core concepts of communities, knowledge, and knowledge creation. Then we address the processes underlying knowledge creation in distributed, online environments, and move on to the role of tacit knowledge in online communication. We conclude by highlighting the gaps in the existing literature in order to point the way to further research on knowledge creation within the field of social computing.

2 KEY CONCEPTS

2.1 Virtual communities

Communities are the context in which knowledge is created and embedded. They may be physical, mental, virtual, or a combination of these (Nonaka & Konno, 1998; Sawhney & Prandelli, 2000; Preece, 2004). In virtual communities, people who share an interest based upon a certain subject or practice interact repeatedly inside certain boundaries and at least partially mediated by conversational, social technologies (Preece, 2000; Wasko & Faraj, 2000; Chiu et al., 2006). Virtual communities of practice (VCoPs), in turn, extend interactions within a specific practice by adding the online environment (e.g., Usoro et al., 2007; von Wartburg et al., 2006). The most prevalent examples of VCoPs are communities of software programmers, as in open-source software development (Hemetsberger & Reinhardt, 2004; Lee & Cole, 2003).

In terms of member participation and knowledge-sharing behavior, studies on virtual communities focus on the enabling role of social-interaction ties (Wasko & Faraj, 2005; Chiu et al., 2006), trust (Ridings et al., 2002; Hsu et al., 2007; Usoro et al., 2007), commitment (Wiertz & de Ruyter, 2007), identification (Bagozzi & Dholakia, 2006), and norms of reciprocity and shared language (Chiu et al., 2006). Knowledge sharing in virtual communities is thus a social process involving complex structures, relational processes and cognitive frames, manifesting the interrelated dimensions of social capital (Wasko & Faraj, 2005; Chiu et al., 2006; Nahapiet & Ghoshal, 1998).

Novel forms of communication technologies significantly affect how organizations and individual knowledge workers locate, share and create knowledge within communities. In particular, *social computing* refers to computing applications that serve as an intermediary or a focus for social relations (Kwai & Wagner, 2007, see also Schuler, 1994). Closely related concepts include *conversational technology* (Wagner & Bolloju, 2005) and *social software*, to which Boyd (2005, ref. in Avram, 2006) gives the following characteristics: support for conversational interaction, support for feedback, and support for building and maintaining social networks. We hereby note the similarity between the three concepts, and approach social computing as *a set of socially-oriented communication technologies characterized by conversational and reciprocal interaction within networks*.

2.2 Tacit knowledge

According to Polanyi (1962), the tacit dimension of knowing is reflected in the process in which we are able to rely on what we are only subsidiarily aware of. Thus, tacit knowledge remains hidden, the focal issue being the way in which a piece of knowledge interacts with other pieces of knowledge (Ancori et al., 2000). Tacit knowledge is described as personal, abstract, difficult to express, and based on experience (e.g., Polanyi, 1962; Meso & Smith, 2000; Nonaka & Konno, 1998). Haldin-Herrgard (2004, 14) enlarges the concept as follows: “*Tacit knowledge is personal, but can be shared by individuals collectively, abstract but expressible in other forms than verbalization, affecting the ability to act independent of activity and competence, and obtained by experience*”.

On the *individual* level, tacit knowledge has two dimensions, the technical and the cognitive (Nonaka, 1991; Nonaka & Takeuchi, 1995). The former refers to skills and *know-how* that are learned implicitly through experience; usually it cannot be articulated or described, but may be transferred to others by observation or by being mentored, for example. Cognitive tacit knowledge, in turn, consists of mental models or exemplars, beliefs and values, providing unconscious reasoning on why we choose certain actions (Schön, 1999; Taylor, 2007).

On the *collective* level, tacit knowledge resides in systemic routines, relationships, roles and the unwritten procedures prevailing in the group. Taylor (2007) refers to collective implicit (tacit) knowledge, which is understood as “the way we do things around here”, and is accessible only to in-group members. Blackler (1995) further identifies a subset, *encultured* knowledge, which refers to knowledge that individuals (within a collective) hold about the cultural or social norms regarding how to behave or interact with other group members in specific situations. Such knowledge is learnt implicitly through on-going socialization (Taylor, 2007). Tsoukas and Vladimirou (2001) argue that organizational knowledge could be thought of as the “corpus of generalizations in the form of generic rules” that are produced by the organization and which its members draw and act upon. According to them, “the social (dimension of knowledge)... is not an aggregation of individual experiences but a *set of background distinctions which underlie individual action*”. In this sense, the social precedes the individual, as individual knowledge is built through socializing, i.e. learning from others within the context of a particular life-world. The concepts of collective knowledge (Spender, 1996), common back face knowledge (Spender, 2002), shared organizing principles (Kogut & Zander, 1992) and routines (Nelson & Winter, 1982) also refer to knowledge that is embedded in forms of social and organizational practice, residing in the tacit experiences and enactment of the collective.

According to Tsoukas (1994; 1996), formistic type of thinking, which is inherent in any typology, eventually sets limitations on understanding knowledge. Tacit and explicit knowledge are mutually constituted, but the former forms the necessary component of all knowledge (ibid.). The way in which a piece of codified information is interpreted, i.e. turned into knowledge as a human characteristic, is dependent upon the context in which it is connected in the thinker’s mind, as well as the way in which it is connected. Thus it is likely that no two individuals, upon getting acquainted with the same piece of codified information, will interpret it in an identical way, because they assimilate it from different backgrounds (individual experiences, worldviews, mindsets) and connect it in different ways. The same piece of codified information will have different meanings to different

individuals, as they connect it with different background knowledge and interpret it from their own perspectives, conditioned by their life experiences, previous understandings, attitudes and values. In a similar vein, the social practices within which individuals are embedded precede the existence of individual knowledge: the individual and collective levels of knowledge interact with each other iteratively and continuously (Ancori et al., 2000).

2.3 Knowledge creation

Arguably the most widely disseminated theoretical model of knowledge creation (Serenko & Bontis, 2004) is the SECI model developed by Nonaka and his collaborators (Nonaka, 1991; 1994; Nonaka & Takeuchi, 1995; Nonaka & Konno, 1998). According to this model, knowledge creation takes place through four conversions between tacit and explicit knowledge. Tacit knowledge is defined as “personal, context-specific, and therefore hard to formalize and communicate”, and explicit knowledge as “knowledge that is transmittable in formal, systematic language”. It is claimed that human knowledge is created through social interaction between tacit and explicit knowledge, and that the articulation of tacit into explicit knowledge is the key factor in creating new knowledge. The SECI model posits four modes of knowledge creation: 1) socialization, when individuals share experiences and thereby create shared tacit knowledge, such as mental models and technical skills; 2) externalization, when tacit knowledge is articulated into explicit concepts through metaphors, analogies, concepts, hypotheses or models; 3) combination, when explicit knowledge is turned into more refined explicit knowledge systems through the combining of different bodies of knowledge; and 4) internalization, when the newly created explicit knowledge is embodied in tacit knowledge. It is argued that the knowledge-creation process is an “ontological” spiral, starting on the individual level and moving up through communities, departments, and organizational boundaries.

The shortcomings of the SECI model can be traced to two main causes. First, it is based on the separability of tacit and explicit types of knowledge. In our view, this is a misreading of Polanyi (1966), the inventor of the concept of tacit knowledge, who in his original work “The tacit dimension” argued: “*The idea of a strictly explicit knowledge is indeed self-contradictory; deprived of their tacit coefficients, all spoken words, all formulae, all maps and graphs, are strictly meaningless*”. In other words, rather than being fundamentally distinct and separable, explicit and tacit knowledge are mutually constitutive. As Tsoukas (2003) puts it, “Tacit knowledge cannot be ‘captured’, ‘translated’, or ‘converted’ but only displayed – manifested – in what we do. New knowledge comes about not when the tacit becomes explicit, but when our skilled performance – or praxis – is punctuated in new ways through social interaction.” According to this view, new knowledge is created through personal insight, which cannot be transferred by socialization, or converted by externalization. It is rather created through “seeing new connections” - by means of discussing and interacting with others, relating to novel contexts and situations, and reflecting on and re-viewing these lessons with “instructive forms of talk” (Tsoukas & Vladimirov, 2001).

Secondly, Nonaka et al. claim that knowledge only exists on the level of individuals. However, account should also be taken of a stream of research encompassing knowledge on collective levels, such as routines, norms, and shared mental models (Nelson & Winter,

1982; Kogut & Zander, 1992; Weick and Roberts, 1993; Spender, 1996; Nahapiet & Ghoshal, 1998).

Lee and Cole (2003) emphasize the importance of examining in detail how knowledge is created in virtual communities. In addressing this issue we draw on a recent study by DeSanctis et al. (2003) in which the authors discuss three types of group learning processes related to online interactions. It should be noted at this point that the relationship between learning and knowledge creation is an unresolved issue in the literature: many authors use these concepts as synonyms (Stacey, 2001; McElroy, 2003), some view learning as the mechanism through which knowledge creation happens (Cohen & Levinthal, 1990), and others argue that knowledge-creation processes are the basis for organizational learning (Nonaka & Takeuchi, 1995). Furthermore, some authors perceive knowledge creation to be a subset of organizational learning (Argote et al. 2003), while others consider the relation to be the other way round (Nonaka & Takeuchi, 1995). In this paper we adopt the view that learning and knowledge creation both address what is essentially the same phenomenon, but tend to be based on different literary traditions.

To return to the study of DeSanctis et al. (2003), the first type of learning is *declarative and procedural information exchange*, which refers to situations in which people seek and provide factual, objective knowledge together (such as question-answer types of exchange). This process is well suited to online venues, and large volumes of exchange are possible. The focus of the learning is more on the knowledge (or know-that) than on the relationships between the parties. Secondly, *transactive learning* refers to the process of sharing information about the knowledge boundaries and capabilities that exist in the group (Wegner, 1986). The boundaries of the learning network are elaborated through discussions on “who knows what”, thus incorporating information about the persons who are involved. Finally, *sense-making* is the process in which shared mental models are developed within the group in order to coordinate efforts, respond to novel events, absorb information, and reduce errors. Of the three processes, sense-making emphasizes tacit knowledge, which is manifested in dialogue including interpretation, exchanging opinions, trying out ideas, reflecting actions, and telling stories. (DeSanctis et al., 2003)

3 ONLINE COMMUNICATION AND KNOWLEDGE CREATION

3.1 The processes underlying knowledge creation online

There is a small body of research focusing on the processes of knowledge creation online (i.e. with the support of computer-mediated technology). Typically, prior studies illustrate two knowledge-creation contexts: open-source software development, and virtual customer communities. This section explores the previous studies in more detail.

3.1.1 Establishing a shared context

According to DeSanctis et al. (2003), a key challenge in online venues is to establish a shared social context, in other words a level of co-presence that promotes a sense of ‘us’ rather than of unconnected individuals. Sharing a social context helps people to make inferences about what others know, and thus to engage in learning and knowledge creation.

In more general terms, research on virtual communities has shown that the development of a shared context is not an online oddity, either: the development of ‘we-intentions’ is a function of social identification and thus represents an increase in norm-accordant behavior (Bagozzi & Dholakia, 2006; Lea & Spears, 1991). Shared interpretations and familiarity with others provides an interpretative background against which information provided is made sensible and meaningful (Alavi & Leidner, 2001; Huysman & Wulf, 2006; Walther, 1996). We argue that the shared background knowledge of virtual-community members is an important contextual factor and input of knowledge creation, as well as an outcome.

3.1.2 Developing routines

DeSanctis et al. (2003, 568) note how online venues that “emulate face-to-face meetings, such as video-conferenced classrooms, are more likely to foster sense-making than asynchronous or text-based venues, since, in the former, dialogue can be rich and rapid, and non-verbal cues are available”. However, they also point out how technology does not fully determine patterns of communication, and that lean media can also produce complex communication (Lea & Spears, 1991; Markus, 1994).

In order to enable sense-making, online groups need to build a coherent social structure. DeSanctis et al. (2003), for example, found that online learners overcame space constraints by *developing routines* of conversation and routines of managing (e.g., setting deadlines, following progress and conducting planned meetings), demonstrating a willingness to modify routines, using the communication space regularly, and showing mutual respect.

3.1.3 Developing norms and a shared culture

When investigating a virtual community of practice dealing with public-sector knowledge management, DeSanctis et al. (2003) found that knowledge exchange occurred on all three levels: the declarative/procedural, the transactive and, over time, also the sense-making level. The success of the learning was facilitated by investment in transactive learning about one another, and by developing a sense of identity and *organizational culture*. Again, such advances were enabled by the helping, friendly and respectful atmosphere in the forum on the one hand, and by the clear purpose and structure on the other (e.g., roles; on the evolution of roles in online technology communities, see Madanmohan & Navelkar, 2004).

Lee & Cole (2003) investigated knowledge-creation processes within the community developing the Linux kernel. They found out that culture was not merely a social-control mechanism through which to manage virtual community membership, make decisions and collectively adhere to *group norms*, it also fulfilled an important function in learning and knowledge creation through criticism and error correction. The socially maintained norm of open sharing is the crux of the community culture.

Reflecting on the process of sense-making (DeSanctis et al., 2003), Lee & Cole (2003) emphasize how criticism serves as a central driver of the learning process within the OSS community. As a mechanism, criticism is supported by the Linux community’s norms and structural arrangements, through which innovations are generated on an ongoing basis. Similarly, Hemetsberger & Reinhardt (2004) refer to “collective reflection-on-action” (Schön, 1999), meaning that developers, relying on patterns of asynchronous

communication, further elaborate on ideas and express different perspectives on the problem through the use of analogies, for example – hence the conversation focuses around the construction of the problem, not its solution (Hemetsberger & Reinhardt, 2004). This is an example of double-loop learning (Argyris, 1992).

3.1.4 *Virtual socialization, externalization, combination, and internalization*

Vaccaro et al. (2008) focus on the effects of virtualization on processes of organizational knowledge creation in general, with a specific focus on innovation activities. They present two case studies from the automotive sector to illustrate the knowledge-creation processes, relying on a variety of ICT tools ranging from computer aided design tools and databases to instant messaging. As a result, ICTs were found to support “*virtual socialization*” by enabling designers to engage in simultaneous design, directly observe each other’s contributions, and give comments using messenger systems. The source of such practice is considered tacit in that it is based on previous experience and complex patterns of expertise that could not be formulated by the designers themselves. The authors thus refer to a virtual ‘ba’, which advances individual and collective knowledge through shared simulations and experimentation.

Another case of virtual socialization is described by Füller et al. (2006). They present an empirical study on innovation activities within virtual customer communities (VCCs), namely, online consumer communities dedicated to the modification of physical products. Members of VCCs innovate not in isolation, but in interaction with like-minded people: they organize design competitions emphasizing the playful element of knowledge creation. By engaging in such activity the designers disclose both explicit and tacit knowledge, i.e. are able to convey values, feelings and perceptions. (Füller et al., 2006).

Vaccaro et al. (2008) also note how online tools have enhanced the potential for knowledge *combination* by increasing the availability of useful sources of explicit knowledge: existing documents and reports are recombined and summarized in new ones. As regards *internalization*, technology supports the knowledge-creation process by means of guided simulation and experimentation through the use of design tools, which allow designers to attend virtual tutorials in which they could ‘internalize working practices’. Furthermore, following Nonaka’s SECI model, Nambisan (2002) developed a design theme related to customer knowledge creation in VCCs. He discusses how new knowledge can be created by combining explicit knowledge, such as flaws within the product, or by converting tacit knowledge into explicit knowledge, such as when customers vote on a design feature. With regard to knowledge conversion, two types of process thus assume importance: *combination* (explicit-explicit) and *externalization* (tacit-explicit). For the latter to occur, customers need to be able to make multiple interpretations of the product or technology in question, and to exchange them with other members of the community.

In sum, the relatively scarce prior work on online knowledge creation can be traced back to two streams: research strictly following Nonaka’s SECI model and the related four modes of knowledge conversion, and studies focusing on the development of shared contexts, routines, norms and organizational cultures.

3.2 The role of tacit knowledge in online communication

We begin this section by briefly introducing two perspectives on computer-mediated (i.e., online) communication. The so-called *rational* perspective (Kock, 2005) stresses the ways in which online media are inadequate to support social interaction (Short et al., 1976; Kiesler et al., 1984), at least when face-to-face interaction as “full bandwidth communication” is seen as the measurement standard (Watt et al., 2002). The rational perspective could also be labelled the *reduced social cues* approach (Culnan & Markus, 1987), and relies on the notions of media richness (Daft & Lengel, 1986) and the level of social presence (Short et al., 1976).

According to the *social* perspective, in turn, the effect of the mediated communication is more dependent on the context within which the media are used. According to the theory of social information processing (Walther, 1996), the reduced social cues do not prevent relational communication, although relationships take a longer time to evolve in online conditions. The theory of social identity and de-individuation (SIDE), in turn, is based on the notion that identification within a group is essential in terms of increasing normative behavior in anonymous online communication. The level of group identification increases in conditions of visual anonymity, and in this sense, mediated communication may be even more socially regulated than face-to-face communication (Lea & Spears, 1991). Watt et al. (2002, 77) note: “Although ‘anarchic’ in the sense of lacking central regulation, the internet seems to be richly social, regulated by its own inhabitants and by group norms”. We consider the development of norms an important characteristic of virtual-community interaction, and decisive for the development of knowledge processes (on the role of norms, see also Chiu et al., 2006; Wasko & Faraj, 2000; Preece, 2004).

Proponents of the SECI model claim that tacit knowledge can only be shared via real-time face-to-face interaction (Nonaka & Takeuchi, 1995; Nonaka & Konno, 1998), while online communication is only suitable for transmitting and combining explicit knowledge. A lengthy period of socialization and the difficult process of externalization are needed in order to reach the point at which virtual interaction can be used for systematizing explicit knowledge bases.

The distinction and conversions between the two types of knowledge also seem to dominate the relatively scarce research on online communication and knowledge creation. Indeed, Hemetsberger & Reinhardt (2004, 4) state how it is necessary “to distinguish between explicit and tacit knowledge” in order to understand the possibilities and difficulties in creating knowledge in an online context. They further note: “Therefore, given that individuals share some common understanding and thus are able to derive meaning from verbalized knowledge, explicit knowledge can efficiently be transferred on virtual platforms” (p. 4). The interesting point is that, while the authors refer to “common understanding” and the group’s ability to “derive meanings”, they do not refer to tacit knowledge. Lee & Cole (2003, 646) suggest that the Linux case is unique due to the fact a computer source code is codified knowledge, which can be explicitly documented as text. Further, they state that it may be more difficult to design knowledge mechanisms for development projects in which “the building blocks are tacit”.

Vaccaro et al. (2008), in turn, report their methodological concerns with regard to the data-collection phase, in other words *how* to distinguish between tacit and explicit knowledge in practice. They looked for particular processes such as intensive joint work related to experimental practices (tacit knowledge) and the preparation of reports (explicit

knowledge). They also asked their interviewees whether the knowledge was available in a codified form as manuals and online guides, or whether it was mainly based on tacit, non-codified expertise.

Based on the above discussions, we offer some concluding notes. Whereas tacit and explicit knowledge are generally considered mutually constitutive and *complementary* forms of knowledge that are inherently linked to each other (Polanyi, 1962; Tsoukas, 1994; 1996), in an online environment explicit knowledge is considered to *substitute* tacit knowing (e.g., Johnson et al., 2002; Hemetsberger & Reinhardt, 2004; Lee & Cole, 2003). The influence of Nonaka's work is evident here, although it could also be assumed that the rational perspective of online communication (focusing on the characteristics of the medium) and the strong tradition of information-system-oriented research on knowledge processes also play a role. According to Watt et al. (2002), perspectives on online communication grounded on the "bandwidth principle" equate the *technical* efficiency of the medium with its *social* efficiency; in other words, the level of sociability is evaluated based on a mechanistic analysis of information transfer. This perspective leaves less space for understanding patterns of social interaction online, however, and particularly its role in knowledge creation. Even when communication is text-based, there is more in the text than simply the words it comprises. In other words, codified information is de-coded or interpreted based on an awareness of the context and expectations of the source (see Weick & Roberts, 1993).

4 CONCLUSIONS

This paper examined prior studies on knowledge creation in order to determine how the role of tacit knowledge and processes of knowledge creation have been addressed in the online environment. We claim that the constructionist view of knowledge provides a fruitful approach. According to this perspective, tacit knowledge is considered "a necessary component of all knowledge" (Tsoukas, 1996). Consequently, it has a part to play even in online interaction, and is shared and transferred online. Furthermore, it provides the interpretative context that enables sense to be made of the information transferred, and thus facilitates knowledge creation.

In sum, there is little research addressing tacit knowledge and knowledge creation that relate to social computing, and the existing literature provides quite a confusing picture. First, some studies mention tacit knowledge, but do not really proceed to explain what is meant by this concept, and there is little explicit discussion on how it is demonstrated in online environments (e.g., Füller et al., 2006). Secondly, several studies deny the role of tacit knowledge, but simultaneously emphasize the importance of collective norms and mental models as enablers of knowledge sharing and creation in virtual communities (e.g., Lee & Cole, 2003; Hemetsberger & Reinhardt, 2004; see also Johnson et al., 2002). Thirdly, in the few studies that do address tacit knowledge, it is portrayed as something distinctly separate and distinguishable from explicit knowledge (e.g. Vaccaro et al., 2008; Chou & Chang, 2008; Preece, 2004).

We have stressed that even if the online environment is beset with apparent limitations due to physical distance, tacit knowledge is by no means absent. We claim that it is a prevalent feature of online communication as it basically enables individuals to communicate with

others and to build new knowledge through interpreting and reflecting the available information in relation to their background knowledge. On the collective level, tacit knowledge is demonstrated in virtual communities as the shared language and understanding of the members and the norms of interaction, which form the invisible social structure and the relational web of interactions in the community (Lee & Cole, 2003; Hemetsberger & Reinhardt, 2004; Chiu et al., 2006; Wasko & Faraj, 2005).

Somewhat paradoxically, research on virtual communities seems to adopt the individual-level view on knowledge. Even though a community is identified - operating online at least to a certain degree and based on common norms and practices, mutual trust, feelings of belonging and a shared language - knowledge as such is not considered on the community level. A general fallacy within the research on tacit knowledge is the reduction of collective patterns to individual explorations, as Taylor (2007) notes: while it is theoretically argued that knowledge may take collective forms, the operationalizations targeting it are still situated on the individual level.

Moreover, although knowledge may be technically labeled collective in research on virtual communities, the actual focus is on the information-sharing behavior among *individuals*, such as the extent of posting and reading messages, rather than on the collaborative creation of new, not pre-existing knowledge (cf. Chou & Chang, 2008, Hsu et al., 2007, Chiu et al., 2006; Ridings et al., 2002; Wasko & Faraj, 2000, 2005). For instance, Chou & Chang (2008) studied an electronic network of practice, focusing on the individual's knowledge-creation intention and behavior. Hence, the authors dismiss the social nature of knowledge creation, even if they note how "*knowledge creation entails not only individual's knowledge sharing and transforming behavior but also complicated social interactions and activities*" (p. 1).

Why is this the case? We could suggest three possible reasons. The first one may relate to the history of communication technologies, as a decade ago social computing was not as extensive and had not developed into the forms it takes today. In organizations, ICTs have had their knowledge-management systems (e.g., Alavi & Leidner, 2001), while group-ware supporting informal communications such as instant messaging, weblogs and forums in professional use are much newer phenomena (e.g., Wagner & Bolloju, 2005). The simple fact is that they have not yet been extensively studied.

Secondly, prior research has typically focused on a set of ICT tools meant primarily for processing, storing and retrieving information, *and not* for maintaining social relations. Not surprisingly, such tools are deemed suitable for supporting explicit knowledge processes, but are suspect in terms of mediating embodiments of tacit knowledge. For instance, Nonaka & Konno (1998, 47) refer to *cyber ba*, a virtual place supporting knowledge conversion by combining existing and new explicit knowledge with the support of group-ware, documentation and databases, and Vaccaro et al. (2008, 4) discuss knowledge creation with the support of computer aided design technologies. Johnson et al. (2002, 253) refer to attempts to use ICTs to develop expert systems, the implementation efforts demonstrating "...that it is difficult and costly to transform expert skills into information that can be used by others". While we certainly agree with such notions, we also note the tendency to view technology as a mere *substitute* for social and personal relationships, consisting of information infrastructures, standards and manuals (Johnson et al., 2002).

This emphasizes the utility-based functions of ICTs (see Ancori et al., 2000) and neglects their potentially *complementary* role in supporting social relationships.

The third reason could be related to the more prevalent question of what is considered scientifically and managerially valuable knowledge. For instance, Ancori et al. (2000, 256) note how “the rapid cumulative expansion of the codified knowledge-base of society is frequently presented as a key characteristic of the development of modern economies and has contributed to the legitimation of the approach *whereby the analysis of knowledge is restricted to its codified form*” (italics added). It is thus suggested that the economic view of measuring and assessing all knowledge as objectively as possible has led researchers to focus on information systems and codified knowledge in the search for sustainable competitive advantage (e.g., Johannessen et al., 2001), not on the much more complex processes of social interaction and informal communications. This may prevent us from seeing the wood for the trees: is it really only codified knowledge that moves in (socially oriented) communication technologies, or is this the only type of knowledge we are equipped to see?

Social computing, when embedded in communities, is not just a vehicle for transferring information – it supports spaces for interaction, dialogue, idea elaboration and play with professional language. Hence, it may facilitate a space for knowledge creation. We believe that knowledge-creation processes in the field of social computing provide an important and promising area for further research.

References

Alavi, M. and Leidner, D. (2001), 'Knowledge management and knowledge management systems: Conceptual foundations and research issues', *MIS Quarterly*, Vol. 25, No. 1, pp. 107-136.

Ancori, B., Bureth, A. and Cohendet, P. (2000), 'The Economics of Knowledge: The Debate about Codification and Tacit Knowledge', *Industrial and Corporate Change*, Vol. 9, No. 2, pp. 255-287.

Argote, L., McEvily, B. and Reagans, R. (2003), 'Managing knowledge in organizations: An integrative framework and review of emerging themes', *Management Science*, Vol. 49, No. 4, pp. 571-582.

Argyris, C. (1992), *On Organizational Learning*, Blackwell, Oxford.

Avram, G. (2006), 'At the Crossroads of Knowledge Management and Social Software', *The Electronic Journal of Knowledge Management*, Vol. 4, No. 1, pp. 1-10. Available at <http://www.ejkm.com>

Bagozzi, G. and Dholakia, U. (2006), 'Open source software user communities: A study of participation in Linux user groups', *Management Science* Vol. 52, No. 7, pp. 1099-1115.

Blackler, F. (1995), 'Knowledge, knowledge work and organizations: An overview and interpretation', *Organization Studies*, Vol. 16, No. 6, pp. 1021-1046.

Boyd, D. (2005), 'The significance of social software'. Available at http://www.zephor.org/thoughts/archives/2005/05/08/the_significance_of_social_software.html

Brown, J. and Duguid, P. (1991), 'Organizational Learning and Communities of Practice', *Organization Science*, Vol. 2, No. 1, pp. 40-57.

Chiu, C-M., Hsu, M-H. and Wang, E. (2006), 'Understanding knowledge sharing in virtual communities: An integration of social capital and social cognitive theories', *Decision Support Systems*, Vol. 42, pp. 1872-1888.

Chou, S.W. and Chang, Y.C. (2008), 'An empirical investigation of knowledge creation in electronic networks of practice: social capital and theory of planned behavior (TPB)', *Proceedings of the 41st Hawaii International Conference on System Sciences (HICSS'08)*.

Cohen, W. and Levinthal, D. (1990), 'Absorptive capacity: A new perspective on learning and innovation', *Administrative Science Quarterly*, Vol. 35, pp. 128-152.

Culnan, M.J. and Markus, M.L. (1987), 'Information Technologies' in Jablin, F.M., Putnam, L.L., Roberts K.H. and Porter, L.W. (eds.), *Handbook of Organizational Communication: An Interdisciplinary Perspective*. Sage, London.

Daft, R.L. and Lengel, R.H. (1986), 'Organizational information requirements, media richness, and structural determinants', *Management Science*, Vol. 32, pp. 554-571.

DeSanctis, G., Fayard, A.-L., Roach, M. and Jiang, L. (2003), 'Learning in Online Forums', *European Management Journal*, October 2003, Vol. 21, No. 5, pp. 565-577.

Füller, J., Jawecki, G. and Mühlbacher, H. (2007), 'Innovation creation by online basketball communities', *Journal of Business Research*, Vol. 60 (2007), pp. 60-71.

Grant, R. (1996), 'Toward a knowledge-based theory of the firm', *Strategic Management Journal*, Vol. 17, pp. 109-122.

Haldin-Herrgard, T. (2004), 'Diving under the surface of tacit knowledge', *Fifth European Conference on Organizational Knowledge, Learning, and Capabilities (OLKC)*, Innsbruck, Austria, 2004.

Hemetsberger, A. and Reinhardt, C. (2004), 'Sharing and creating knowledge in open-source communities – the case of KDE', *Fifth European Conference on Organizational Knowledge, Learning, and Capabilities (OLKC)*, Innsbruck, Austria, 2004. Available at <http://opensource.mit.edu/papers/hemreinh.pdf>

Hsu, M.-H., Ju, T.L., Yen, C.-H. and Chang, C.-M. (2007), 'Knowledge sharing behavior in virtual communities: The relationship between trust, self-efficacy, and outcome expectations', *International Journal of Human-Computer Studies*, Vol. 65, pp. 153-169.

Huysman, M. and Wulf, V. (2006), 'IT to support knowledge sharing in communities, towards a social capital analysis', *Journal of Information Technology*, Vol. 21, pp. 40-51.

Johannessen, J.A., Olaisen, J. and Olsen, B. (2001), 'Mismanagement of tacit knowledge: the importance of tacit knowledge, the danger of information technology, and what to do about it', *International Journal of Information Management*, Vol. 21, pp. 3-20.

Johnson, B., Lorenz, E. and Lundvall, B.Å. (2002), 'Why all this fuss about codified and tacit knowledge?', *Industrial and Corporate Change*, Vol. 11, No. 2, pp. 245-262.

Kiesler, S., Siegel, J and McGuire, T. (1984), 'Social Psychological Aspects of Computer-Mediated Communication', *American Psychologist*, Vol. 39, pp. 1123-34.

Kock, N. (2005), 'Media Richness or Media Naturalness? The Evolution of Our Biological Communication Apparatus and Its influence on Our Behaviour Toward E-Communication Tools', *IEEE Transactions on Professional Communication*, Vol. 48, No. 2, pp. 117- 130.

Kogut, B. and Zander, U. (1992), 'Knowledge of the firm, combinative capabilities, and the replication of technology', *Organization Science*, Vol. 3, pp. 383-397.

Kwai Fun IP, R. and Wagner, C. (2007), 'Weblogging: A study of social computing and its impact on organizations', *Decision Support Systems*, 2007 (in press).

Lave, J. and Wenger, E. (1991), *Situated Learning: Legitimate Peripheral Participation*, Cambridge University Press, Cambridge.

Lea, M. and Spears, R. (1991), 'Computer-Mediated Communication, De-Individuation and Group Decision-Making', *International Journal of Man-Machine Studies*, Vol. 34, pp. 283-301.

Lee, G.K. and Cole, R.E. (2003), 'From a Firm-Based to a Community-Based Model of Knowledge Creation: The Case of the Linux Kernel Development', *Organization Science*, Vol. 14, No. 6, 633-649.

Leonard-Barton, D. (1995), *Wellsprings of Knowledge. Building and Sustaining the Sources of Innovation*, Harvard Business School Press, Boston.

Madanmohan, T.R. and Navelkar, S. (2004), 'Roles and knowledge management in online technology communities: an ethnography study', *International Journal of Web Based Communities*, Vol. 1, No. 1, pp. 71-89.

Markus, M.L. (1994), 'Electronic mail as the medium of managerial choice', *Organization Science*, Vol. 5, No. 4, pp. 502-527.

McElroy, M. (2003) *The new knowledge management: Complexity, learning and sustainable innovation*, Boston, Butterworth-Heinemann.

Meso, P. and Smith, R. (2000) 'A resource-based view of organizational knowledge management systems', *Journal of Knowledge Management*, Vol. 4, No. 3, pp. 224-234.

Nahapiet, J. and Ghoshal, S. (1998), 'Social Capital, Intellectual Capital, and the Organizational Advantage', *Academy of Management Review*, Vol. 23, No. 2, pp. 242-266.

Nambisan, S. (2002), 'Designing virtual customer environments for new product development: toward a theory', *Academy of Management Review*, 2002, Vol. 27, No. 3, pp. 392-413.

Nelson, R. and Winter, S. (1982), *An evolutionary theory of economic change*, Harvard University Press, Cambridge.

Nonaka, I. (1991), 'The knowledge-creating company', *Harvard Business Review*, November-December, pp. 96-104.

Nonaka, I. (1994), 'A dynamic theory of organizational knowledge creation', *Organization Science*, Vol. 5, No. 1, pp. 14-37.

Nonaka, I. and Takeuchi, H. (1995), *The knowledge-creating company*, Oxford University Press, New York.

Nonaka, I. and Konno, N. (1998), 'The Concept of "Ba": Building a Foundation for Knowledge Creation', *California Management Review*, Vol. 40, No. 3, 40-54.

- Polanyi, M. (1962), *Personal knowledge*, University of Chicago Press, Chicago.
- Polanyi, M. (1966), *The tacit dimension*, Routledge, London.
- Preece, J. (2000), *Online communities. Designing usability, supporting sociability*, Wiley, Chichester.
- Preece, J. (2004), 'Etiquette, empathy and trust in communities of practice: Stepping-stones to social capital', working paper. Available at http://www.ifsm.umbc.edu/~preece/Papers/Tacit_Know_COPs.pdf
- Ridings, C., Gefen, D. and Arinze, B. (2002), 'Some antecedents and effects of trust in virtual communities', *Journal of Strategic Information Systems*, Vol. 11, pp. 271-295.
- Sawhney, M. and Prandelli, E. (2000), 'Communities of creation: Managing distributed innovation in turbulent markets', *California Management Review*, Vol. 42, No. 4, pp. 24-54.
- Schuler, D. (1994), 'Social computing', *Communications of the ACM*, Vol. 37, No. 1, pp. 28-29.
- Schön (1999), *The Reflective Practitioner – How Professionals Think in Action*, Basic Books, New York.
- Serenko, A. and Bontis, N. (2004) 'Meta-review of knowledge management and intellectual capital literature: Citation impact and research productivity rankings', *Knowledge and Process Management*, Vol. 11, No. 3, pp. 185-198.
- Sharpton, T.J. and Jhaveri, A.A. (2006), 'Leveraging the Knowledge of Our Peers: Online Communities Hold the Promise to Enhance Scientific Research', *PLoS Biology*, June 2006, Vol. 4, No. 6, pp. 0904-0905.
- Short, J.E., Williams, E. and Christie, B. (1976), *The Social Psychology of Telecommunications*, London, Wiley.
- Spender, J.-C. (1996), 'Organizational knowledge, learning and memory: Three concepts in search of a theory', *Journal of Organizational Change*, Vol. 9, No. 1, pp. 63-78.
- Spender, J.-C. (2002) 'Knowledge, Uncertainty, and an Emergency Theory of the Firm' in C. W. Choo and N. Bontis (eds.), *The strategic management of intellectual capital and organizational knowledge*, Oxford University Press, pp. 149-162
- Stacey, R. (2001) *Complex responsive processes in organizations: Learning and knowledge creation*, London, Routledge.
- Taylor, H. (2007), 'Tacit Knowledge: Conceptualizations and Operationalizations', *International Journal of Knowledge Management*, Vol. 3, No. 3, pp. 60-73.

Teece, D., Pisano, G. and Shuen, A. (1997), 'Dynamic capabilities and strategic management', *Strategic Management Journal*, Vol. 18, pp. 509-533.

Tsoukas, H. (1994), 'Refining common sense: Types of knowledge in management studies', *Journal of Management Studies*, Vol. 31, No. 6, pp. 761-780.

Tsoukas, H. (1996), 'The firm as a distributed knowledge system: A constructionist approach', *Strategic Management Journal*, Winter 1996, Vol. 17, pp. 11-25.

Tsoukas, H. and Vladimirou, E. (2001), 'What is organizational knowledge?', *Journal of Management Studies*, Vol. 38, No. 7, pp. 973-993.

Tsoukas, H. (2003), 'Do we really understand tacit knowledge?' in M. Easterby-Smith and M. Lyles (eds.) *Handbook of organizational learning and knowledge management*, Oxford, Blackwell, pp. 410-427.

Usoro, A., Sharratt, M.W., Tsui, E. and Shekhar, S. (2007), 'Trust as an antecedent to knowledge sharing in virtual communities of practice', *Knowledge Management Research & Practice*, Vol. 5, pp. 199-212.

Vaccaro, A., Veloso, F. and Brusoni, S. (2008), 'The impact of virtual technologies on organizational knowledge creation: an empirical study', *Proceedings of the 41st Hawaii International Conference on System Sciences (HICSS'08)*. Available at <http://csdl2.computer.org/comp/proceedings/hicss/2008/3075/00/30750352.pdf>

Wagner, C. and Bolloju, N. (2005), 'Supporting Knowledge Management in Organizations with Conversational Technologies: Discussion Forums, Weblogs, and Wikis', *Journal of Database Management*, Vol. 16, No. 2, pp. i-viii.

Walther, J. (1996), 'Computer-mediated communication: impersonal, interpersonal and hyperpersonal interaction', *Communication Research*, Vol. 23, No. 1, pp. 3-43.

von Wartburg, I., Rost, K. and Teichert, T. (2006), 'The creation of social and intellectual capital in virtual communities of practice: shaping social structure in virtual communities of practice', *International Journal of Learning and Change*, Vol. 1, No. 3, 299-316.

Wasko, M. and Faraj, S. (2000), 'It is what one does': why people participate and help others in electronic communities of practice', *Journal of Strategic Information Systems*, Vol. 9, pp. 155-173.

Wasko, M. and Faraj, S. (2005), 'Why should I share? Examining social capital and knowledge contribution in electronic networks of practice', *MIS Quarterly*, Vol. 29, No. 1, pp. 35-57.

Watt, S, Lea, M. and Spears, R. (2002), 'How Social is Internet Communication? A Reappraisal of Bandwidth and Anonymity Effects' in Woolgar, S. (ed.), *Virtual Society? Technology, Cyberbole, Reality*, Oxford University Press, New York, pp.61-77.

Weick, K. and Roberts, K. (1993) 'Collective mind in organizations: Heedful interrelating on flight decks', *Administrative Science Quarterly*, Vol. 38, pp. 357-381.

Wegner, D.M. (1986), *Transactive Memory: A Contemporary Analysis of the Group Mind. Theories of Group Behavior*, New York, Springer-Verlag.

Wiertz, C. and de Ruyter, K. (2007), 'Beyond the Call of Duty: Why Customers Contribute to Firm-hosted Commercial Online Communities', *Organization Studies*, Vol. 28, No. 3, pp. 347-376.