Knowledge Discourses and Interaction Technology

Carsten Sørensen & Masao Kakihara
Department of Informations Systems
London School of Economics & Political Science
London, Great Britain
{c.sorensen; m.kakihara}@lse.ac.uk

Abstract

Research within knowledge management tends to either overemphasize or underestimate the role of Information and Communication Technology (ICT). Furthermore, much of the ICT support debate has been shaped by the data-information-knowledge trichotomy and too focused on repository-based approaches. We wish to engage in a principled debate concerning the character and role of knowledge technologies in contemporary organizational settings. The aim of this paper is to apply four perspectives on the management of knowledge to highlight four perspectives on technological options. The paper presents, based on four knowledge discourses – four interrelated perspectives on the management of knowledge – four perspectives on ICT support fir the management of knowledge each reviewing relevant literature and revealing a facet of how we can conceptualize the role of technology for knowledge management. The four technology discourses focus on the: Production and distribution of information; interpretation and navigation of information; codification and embedding of collaboration; and establishment and maintenance of connections..

1. Introduction

To date the knowledge management debate has shown many interesting facets. It represents a multitude of perspectives each with its own distinct agenda and assumptions. In fact, it can be argued that the success of knowledge management as a research field is grounded in the loosely defined agenda allowing researchers and practitioners with different perspectives to engage in a rich but also often somewhat confusing debate. One of the most contentious issues has been the exploration of Information and Communication Technology (ICT) as a means of supporting the management of knowledge [71; 91]. Research informed by organizational theory argues for increased focus on the complex, contextual, human and social issues surrounding an understanding of knowledge in organizations. At the same time, there is significant interest within computing, engineering and industrial communities in developing and using increasingly complex knowledge management systems. Comparing the technological skepticism within the social science community with the technological optimism within the engineering and business community, there seems to be a need for a principled debate of the possibilities for and limitations of ICT support for the management knowledge in organizations [56]. Such a debate must be informed by: (1) Organizational theories, enabling a comprehensive understanding of the management of knowledge in organizational setting; (2) theories on the use of ICT emphasizing in particular the intricate relationships between work practices and the characteristics of ICT; and (3) specific knowledge on the contemporary technological options that are available.

The aim of this paper is therefore to explore and characterize the technological options for supporting the management of knowledge through the application of four interrelated knowledge discourses. The paper adopts a theoretical method attempting analytical synergy between elements from all the three areas listed above. This is accomplished by reviewing four different knowledge discourses - knowledge as object, interpretation, process and relationship - and based on these, drawing upon research on socio-technical choices within several academic fields - Human-Computer Interaction (HCI), Computer Supported Cooperative Work (CSCW), Information Retrieval (IR), and the more general field of Information Systems (IS). The paper maintains a general perspective debating analytical distinctions between types of ICT supporting the management of knowledge. Within explicitly socio-technical areas such as CSCW, HCI, and IR, significant efforts have been made to unpack the complex relationships between organizational activities and technological support. However, this research has not been anchored within knowledge discourses substantially informed by social science theories. This previous research has focused on the relationships between work activities and technology use at an operational level. In this paper however and based on the four knowledge discourses, we discuss the types of ICT functionality these perspectives on the management of knowledge may inspire.

2. Knowledge Discourses

The management of knowledge implies the enhancement of learning and performance in organizations through processes and practices of creating, acquiring, sharing and using knowledge irrespective of where it resides [71]. Several perspectives can be applied when considering knowledge and the management of knowledge in organizations. For example, Swan and Newell [90] offer three perspectives linking knowledge management and innovation within an organizational context: The Cognitive, the Community, and the Networking Model. Swan and Newell focus on the role of different knowledge management strategies for organizational innovation processes. We are, however, here primarily interested in the principled technological options and not in the innovation processes from which the actual utilization of the technological options results. We are, thus primarily interested in the *potential* for an ICT innovation to support the management of knowledge and secondarily in the styles of knowledge management best applied in certain contexts. Based on a synthesis of several epistemologies, we suggest the following four knowledge discourses; knowledge as *object*, knowledge as *interpretation*, knowledge as *process* and knowledge as *relationship* [38]. These four knowledge discourses are presented below each as four analytically distinct but in practice interrelated discourses on knowledge.

2.1 Knowledge as Object

Representationism is a fairly traditional approach for understanding organizational knowledge in contemporary management studies. A representationsist view on knowledge is based on the following assumptions [1; 38]:

- Knowledge is seen as a representation of a pre-given world
- Human intelligence can be seen as information processing and rule-based manipulation of symbols
- Knowledge results from human beings 'performing' information processing
- Knowledge is seen as objectified and transferable
- Learning is thought of as creation of the most accurate or "truthful" representations of the objective world

In summary, a knowledge discourse based on these assumptions can be characterized as one objectifying knowledge. In management studies, this discourse of knowledge can be associated with Herbert Simon's information-processing paradigm. Simon's work [80; 81] has without doubt contributed enormously to the development and refinement of management science in 1970s and 80s, particularly in functional analysis and problem-solving frameworks and the dominant perspective within much of the KM debate [71]. Based on the Simonian view of the organization, conventional KM research has seen knowledge as objectified and codified – similar to data – and sought an effective utilization of ICTs for coordinating such codified knowledge. It could be argued that the discourse on knowledge as object has contributed in clarifying the explicit and relatively static aspects of organizational knowledge. However, viewing knowledge in a similar way as data and information easily leads to a mechanistic, technology-driven knowledge discourse. The knowledge as object paradigm presupposes that knowledge is an objective and stable entity traveling within and between organizations rendering it on par with physical resources in organizations such as money, labor and land. This paradigm seems to have dominated the knowledge discourse within management studies, and as a result of calls for a broader debate, alternative discourses have emerged [e.g. 3; 13; 93; 95].

2.2 Knowledge as Interpretation

In spite of the pervasiveness of the idea in current management studies that knowledge is a transferable object, this view has more recently been subject to various criticisms [93; 96; 99; 102]. The most significant problem is the idea of representation and the information-processing view of human intelligence. In the traditional representationist view of the world, the fundamental assumption is that the world is pre-given, and its aim is to create the most accurate or 'truthful' representations of this objective world. However, some knowledge cannot be codified, transmitted, or processed in mechanistic or functional ways. Knowledge remains tacit and personal to some extent and involves particular properties that cannot be appreciated when decomposed into parts [67]. Based on an *anti-representationistic* view, several new discourses on knowledge have emerged. The discourse on knowledge as *interpretation* recognizes that knowledge inherently is associated with human subjective interpretations and dependent very much on 'the point of observation' of the interpreter [96]. The process of interpretation simultaneously shapes and is shaped by social reality [5; 78]. Winograd and Flores [102] argue that knowledge is always the result of humans' mutual interpretive action and linguistic behavior, which depends on the entire previous experience of the interpreter and on situatedness in social convention and tradition. Given the concept of knowledge as the result of human interpretations, the notion of communication, too, should be reconsidered, since the notion of communication in the traditional managerial and organizational context has presupposed the information-processing view of organization. It could be argued that the concept of knowledge cannot be fully grasped and dealt with without taking into account human interpretative behavior. The concept of knowledge as intersubjective interpretations and its theorization in the organizational context have consequently emerged with in the last two decades [e.g. 16; 61; 93; 97; 99].

2.3 Knowledge as Process

It is important to recognize the dynamic and fluid aspects of knowledge. That knowledge emerges out of dynamic processes between subjectivity (belief) and objectivity (truth) has been a classic discourse since Polanyi [66; 67]. Little attention has however been paid to this perspective within the KM community, although Schultze [76] conducts a comprehensive analysis of interpretive behavior balancing objectivity and subjectivity in the production of information objects. It is however, crucial to subsume the uncodified, tacit world of knowledge into its research perspective on KM. The knowledge as process discourse views reality as a whole and knowledge in particular as processes. Whitehead [100] challenges the fundamental dualism between subject and object, namely that between mind and body, and propose that reality is no longer viewed as a superficial, accidental changing of its static structure, but as a continuous process and an active alteration in the very fabric of reality itself. From a process-oriented view, knowledge is not a static entity but the manifestation of a dynamic process of 'knowing' by which human beings make sense of the world and reality [94]. It seems that the process view of knowledge, or knowing, has gradually permeated the research field of management and organization studies as a whole. Weick [98], for example, uses the term *organizing* rather than organization, shedding a light upon the continuous process of organizational behavior. Senge, applying the systems thinking to the study of learning organization, also stressed that in order to apprehend organization's reality, "seeing processes of change rather than snapshots" is crucial [79, p.73]. Both Weick and Senge warn that the static and cause-effect based view toward an organization is dangerous for understanding complex problems the organization faces. Nonaka and Tekeuchi [61], advocate for the 'knowledge-*creating* company,' and argue that knowledge should be viewed as "a dynamic human process of justifying personal belief toward the 'truth'" (p. 58). Spender focus on "the processes that generate, distribute and apply" the firm's intangible knowledge assets [86, p.235]. The shift of analytical focus from knowledge as a static state towards dynamic process has mainly been observed within the research into Organizational Learning. As Scarbrough et al. [71] argue, although closely linked, there are latent differences between the research fields of Organizational Learning and Knowledge Management. Some attempts have been made to combine the two sets of concerns, for example by Ciborra and Andreou [14].

2.4 Knowledge as Relationship

Closely related to the two discourses on knowledge discussed above, another important discourse has emerged: the concept of knowledge as *relationship*. Knowledge can be viewed as intrinsically *relational* to its surrounding world. Knowledge is a result of human mental acts, be it individual, group, or social, and those acts are dependent on various socio-cultural contexts. At the same time, human mental acts, along with linguistic acts, continuously shape social reality and can induce new contextual drifts of the world [5; 57]. Dilthey argues that the very essence of reality and human knowledge exists in the relationship between subject and object [19]. From this point of view, knowledge does not exist in an isolated state in the objective world, but resides within a variety of contextual factors that are inseparably connected with the knowledge. Knowledge thus can be seen as an *interconnected web of relationships* in which human interpretative acts ceaselessly shape and maintain, both intentionally and unintentionally, the relational setting of the web and contextual disposition of the social reality. Knowledge is here perceived as intrinsically depending on a set of relationships to other knowledge. In the recent management studies, the idea of knowledge as relationship is increasingly significant in particular when linked to the concept of the network organization. Largely helped by the development and diffusion of ICT, in particularly the Internet, organizations can now to some extent free themselves from geographical drawbacks and institutional incompatibilities over the various boundaries. Organizations are now becoming *network organizations*, ensuring that they design and redesign their organizational structures and business settings flexibly and dynamically [37; 69; 87]. Castelles [12] argue that networking behavior of organizations transforms not only the operational processes of business but also social structures. This implies a change in the significance of the concept of knowledge for organizations. For network organizations, with whom and how they are connected is much more important than what they possess. In other word, the relationship to other players and/or resources is the crucial factor for building and maintaining sustainable competitiveness. In this new reality knowledge in an organization thus should be viewed in terms not only of possession and storing but more importantly, relationship and connectedness.

3. Technology Discourses

The four knowledge discourses outlined above, raise a number of pertinent issues concerning the potentially supportive role of ICT in the management of knowledge within organizations. The Knowledge Management debate has generally not been concerned with detailed principled discussions of types of ICT support for knowledge management. The literature is either relative vague about the potential types of technological support for knowledge management, or it discuss in great detail actual systems features with little general discussion. Much of the debate of ICT support discuss how to capture, store and retrieve codified knowledge in databases, i.e., a repository-based approach [2; 42; 71]. However, we would argue that the debate much be much broader both in terms of the extent

to which different types of information and communications technologies support knowledge-work. As this is an attempt to raise more principled issues concerning types of ICT support for the management of knowledge, we have engaged in an open discourse of which types of technologies naturally could be discussed within each of the four perspectives on knowledge. It is meant as a first attempt at mapping technological options in general. As such it may seem naïve given the lack of actual context for the context of technology use.

3.1 Producing and Distributing Information

The knowledge as object discourse naturally implies a technology discourse focusing on the support for production, distribution and consumption of information in distributed organizational settings. Much of the early knowledge management debate concerned support of organization wide access to 'knowledge' repositories [2; 42]. Here, the first crucial issue is the focus on supporting organization wide access to 'knowledge' bases. This could be in the form of either structured databases or semi-structured document collections in intranets [91]. The primary design aim is to codify organizational knowledge so it is representable in an explicit form and readily available for the members. The rapid adoption of Internet-based company intranets is a good example of technology discourses concerned with knowledge as an object. The basic technologies are a combination of the existing organizational infrastructure of networked PCs, free TCP/IP communications protocol software, and free or inexpensive server and application software (e.g., http server software, html web browser software). This configuration quickly established intranet systems separate from the existing administrative systems in organizations, with the substantial problems of maintaining the intranets.

Although it can be argued that any provision of ICT support to some extent will rely on codification, this perspective in particular lends itself to a debate of knowledge codification. Here, some of the debate has been concerned with the relative importance of codification of knowledge as opposed to social processes of collaboration [85; 91]. It can be argued that there is a dynamic relationship between the rigid systems of classification and their daily use and that engaging in codification and classification of knowledge inherently must be viewed as a collaborative process [18]. Establishing socially recognized categories within a particular domain require social processes of negotiation and the daily use of categories is a constant negotiation between the formalized categories and the pragmatics of applying them in practice [8; 85]. This concern for the collaborative production and consumption of information representing the explication and codification of individuals' experience and knowledge also raises the issue of effort versus reward [63]. If the 'knowledge' bases are maintained by one group of people, such as the management consultants in Orlikowski's example, and another group potentially reaps the benefits — the consultancy firm partners or the individual consultants peers — then this can affect the quality of the information in the system significantly.

3.2 Interpreting and Navigating Information

ICT increasingly support the production and consumption of highly complex information and supports individuals' decision making. Considering the knowledge as interpretation discourse naturally direct our focus towards supporting the individual in producing, transmitting, retrieving, consuming, assessing and discarding both structured and unstructured information. Moving from knowledge as object to knowledge as interpretation implies acknowledging that each individual will engage in complex patterns of interpretation in order to carry out their work activities [88; 89] and these activities are supported by various technologies. For example, working with information in the form of documents demonstrates one particular important perspective on the interaction between the social and the technical spheres. Studies of the daily use of documents in organizations as means of managing and interpreting information have demonstrated highly complex patterns of interpretation [36; 52; 76], as well as the fluid and fixed character of both physical and digital documents [46]. The emergence of the Internet as a hypertexted world of bits has facilitated multiple voices to be heard within organizations and a relative lower barrier for diffusing individual interpretations to a wider audience through for example emails or by publishing web pages on the Internet or on the company intranet [68]. This implies that the processes of interpretation are increasingly conducted in an arena outside the familiar one of paper-based work.

A further complication is the co-existence of the paper-based and electronic worlds presenting issues such as the life of documents and their migration between various states of being paper-based and digital [9; 10]. Consequently, people managing knowledge increasingly consume and produce information using complex ICTs supporting information filtering, making annotations, linking documents or parts of documents, and classification of information according to their individual interpretational preferences [53; 62; 85]. The basic techniques applied for the support of interpretation and navigation of information spaces are information filtering, user modeling and software agents [62; 83; 84]. This raises important questions concerning the allocation of functionality between humans and systems, where the design issue becomes one of deciding to what extent the governing principle should be direct manipulation where the user at any time is perceived to have full control over the interaction, as opposed to explicitly allocating functionality to software agents [45; 54] carrying out routine tasks on behalf of the user [74]. There are several arguments for increasingly supporting the management

and interpretation of information using software agents. For example, using software agents for the indexing of large unstructured information spaces according to certain areas of interest and perspectives, and also the navigation of these information spaces [22; 23; 59; 83; 84]. One of the significant problems here, however involves the design of software agency that supports processes of interpretation without the individual's delicate understanding and preferences being subsumed within crude and inappropriate classifications encoded in the software agent.

Information overload is one of the possible consequences of increased use of ICT supporting the retrieval, interpretation and production of information [6; 33; 59; 64; 77]. The concept was originally perceived of as phenomenon in itself, emerging as a result of an individual being subjected to a demand for processing information above their cognitive capacity. This led to studies of how information technology could support the processing and presentation of information reducing the risk of the individual user experiencing information overload [33]. However, current research has demonstrated that information overload should be viewed as a relationship between the technology and a wider organisational context. Schultze and Vandenbosch [77] show that the use of Lotus Notes initially led to participants perceiving themselves subject to information overload, but a later sample showed no signs of perceived information overload. In other words the users had gradually adapted in order to cope with the technology. The knowledge as interpretation discourse raises the issue of supporting knowledge workers interpreting vast amounts of both structured and ill-structured information.

3.3 Codifying and Embedding Collaboration

The knowledge as object discourse inspired a discussion of technologies supporting codification of static aspects of the work, or for example in the case of basic intranet systems, static representations of work procedures. Viewing knowledge as process, however helps us appreciate the everyday accomplishment of knowledge work as distributed social processes of interaction [93]. Focusing on the dynamic and performative aspects of knowing in organizations, naturally leads the discussion of technological options towards the support for conducting work processes and the representation of work processes within information and communication technologies. If we for example consider communities of practice working together, then a focus on the dynamic aspects of the collaboration facilitates a debate of how to provide technological support in general and computer-support in particular of distributed interdependent collaborative processes of knowing.

Clearly, there are a host of technologies that can be viewed as supporting collaboration in some way of other. However, there are several technologies that specifically support collaborative work processes. For example, within the office domain, the debate in the 1980s concerned Office Automation [35]. Here the aim was to streamline office work by advanced document and workflow management systems. However, the aim of the paper-less and fully automated office proved difficult to realize. Part of the problem concerned the extent to which the actual work conducted is recognized by the people formalizing and seeking to automate the work [88]. Another major hurdle encountered was the difficulty involved in codifying and stipulating distributed collaborative work activities whilst at the same time allowing sufficient flexibility of the work processes [28; 73]. The debate around ICT support for collaborative work broadened to other domains other than office work, and since the mid-80s it has been carried out in the Groupware [27; 28; 29] and the Computer Supported Collaborative Work (CSCW) communities [4; 72]. The emerging technical infrastructures of networked PCs and the Internet standards has brought the technological debate from proprietary organizational solutions to open standards.

In the sense that supporting processes of knowing with ICT can be viewed as support of distributed collaborative activities, there are a number of issues to consider. Exploring how to support processes of knowing with ICT points towards support for collaboration. This is an area that has been, and still is, subject to intense development and debate within several academic communities. We have chosen to characterize the support for collaborative activities in terms of shared workspaces, co-ordination mechanisms, and mutual awareness support [20; 70; 72; 73; 82].

Shared workspaces, or common information spaces [72] support the sharing of work materials across temporal and spatial barriers. This can, for example, be web-servers or Lotus Notes discussion databases. Individual members can store and retrieve objects, and there may be some support for collaborative updating of shared objects.

A **co-ordination mechanism** denotes a set of conventions and prescribed procedures supported by a combination of classification structures and protocols. [73]. Co-ordination mechanisms can be viewed as a means of supporting more stable aspects of collaborative processes. It is a conceptual framework for describing artifacts supporting the process of coordinating who is doing what, when, where, how, and why. Co-ordination mechanisms can potentially reduce the complexity of articulating and coordinating distributed interdependent work processes [11; 73].

Mutual awareness support enables participants maintaining awareness of where others are located, what they currently are doing [20; 70; 73; 82]. Mutual awareness is obtained in co-located settings through a host of unobtrusive and ephemeral modes of interaction [73], and temporally and spatially distributed collaboration through electronic media spaces proves problematic due to the constraints imposed by the

technology in terms of providing mutual awareness, for example in terms of vision, listening, movement, interactive movement and predictable interaction [25]. Mutual awareness will also be discussed in the next section when considering knowledge as relationships.

The functional hierarchy would by its embedded standard operating procedures and functional division of responsibility and competence, reduce the complexity of coordinating distributed activities. However, in flatter modes of organizing, there are no hierarchies and probably few procedures to support and guide the processes of knowing [7]. Supporting processes of knowing relies to some extent on externalized representations of work processes [55], and these codifications of people, activities, resources, tasks etc, can for example in the shape of scheduling systems, workflow management systems and classification schemes [73; 85] both restrict the individuals' process of knowing and support collective processes by supporting the sharing of work materials or by embedding and standardizing coordination complexity within technological artifacts. Traditionally, co-located collaborators will engage a rich suite of ephemeral, unobtrusive modes of interaction when articulating work activities [30; 31].

Considering the increasing complexity of processes of knowing could also point towards increases in the problems of deploying ICT based co-ordination mechanisms stipulating the co-ordination of working processes. We term this condition *structure overload*, i.e., the situation where the technology unnecessarily constrains the processes of knowing by imposing structural constraints. Structure overload can be compared to the problems experienced by organisations attempting to adapt to environmental demands for flexibility, whilst being disadvantaged by existing organisational structures.

3.4 Establishing and Maintaining Connections

The knowledge as relationship discourse leads us to contemplate the role of ICTs for establishing and maintaining relationships, connections, or networking [48; 87], i.e., the support for interaction within distributed processes of knowing. Knights et al. [40] argue that increasingly flat organizational hierarchies can lead to networking as a dominant form of organizing and that networking in that sense is the essence of knowledge work. In lateral organizational forms, particular requirements can be imposed on the communication technologies in terms of supporting communities of knowing [7], and electronic communication technologies plays a central role for constructing the networked organization [43]. Managing relationships has in the literature been discussed in terms maintaining weak and strong ties [26; 65; 101]. In this respect, simple communication technologies such as electronic mail, bulletin boards and on-line discussion groups can be viewed as contributing to the maintenance communities of relationships [45; 65]. Robertson et al. [68] documents a case where the use of email was the primary means of networking and of negotiating project participation in a knowledge intensive firm.

There is currently significant innovation of information infrastructures supporting textual and verbal communication, e.g., digital cellular phone standards and Internet-based protocols for email and voice-over-IP. It is, therefore important to understand patterns of communication and media choice [34; 65; 92]. It is also important to consider the social construction and contextual nature of electronic conversations [44; 58] beyond the simple understanding of media richness theory [15]. The virtualization of co-located work settings raises a host of essential questions concerning the possibilities for and limitations of ICT support. The complexity of supporting distributed collaboration is to a large extent caused by the inability to employ the same modes of interaction as when collaborating "at arms length" [25; 31; 72]. The richness of human interaction and the extent of situational awareness when collaborating at arms length has been discussed at length within the CSCW community [31; 32]. Characterizing modalities of interaction in terms of the degree of obtrusiveness and the relative persistency and ephemerality, it is clear that most ICTs do not sufficiently support unobtrusive and ephemeral modes of interaction [25; 49; 50; 73]. The MediaSpace project at Xerox conducted experiments with the use of video connections as a means of maintaining peripheral awareness and demonstrated the limitations of video technology for maintaining mutual awareness [32].

Recent years has seen increasing development and use of technologies supporting distributed mutual awareness, such as email, mobile phones, faxes, voice mails, Short Message Service (SMS), Netmeeting videoconferencing, ICQ (I Seek You, at www.icq.com), and Microsoft MSN Message Service just to mention a few. For example, ICQ allows people to become aware of others' availability, i.e., whether they are online, busy, available, away from the computer etc. This applications also support online persistent conversations through text messages. This type of software has been named AwareWare [60] and is characterized in terms of synchronous or asynchronous modes of awareness through visual or verbal media. Technologies such as ICQ, MSN Message Service and SMS are increasingly becoming adapted amongst teenagers as inexpensive means of maintaining constant awareness of others whereabouts, what they are doing and for engaging in discussions [41]. The emergence of mobile information devices raises the importance of providing support for maintaining connections and mutual awareness in mobile settings [21; 51], indeed it raises the general issue of how to theoretically understand mobility [39].

The lack of organizational structures and the ready availability of communication means, implies that the individual must manage their availability to others and

the extent to which they network. Structure overload as discussed above implies over-constraining the environment for interaction by relying too strictly on embedding aspects of the articulation of distributed collaborative activities in co-ordination mechanisms. When discussing the application of awareness technologies as a means of establishing virtual spaces of interaction and mutual awareness, under-constraining the environment can be characterized as interaction overload. Attention can therefore be viewed as a scarce commodity [75] which in flattened organizations and with communication technologies that enables instant access to everyone, might result in imbalances between individuals' collaborative preferences and the experienced level of interaction [34; 50]. For example, Mackay [53] analyzed the use of email in a software project, where some were overwhelmed by email and others coped. She classified the participants into the prioritizers who managed their interaction by being selective as opposed to the archivists who was barely coping with information overload because they intended to archive and classify all interaction. [53]. Mackay only considered the management of interaction through one technology, email. Hinds and Kielser [34] also considered the management of multiple communication technologies but did not consider the issue of being subjected to an abundance of information . It has been suggested that the management of interaction technologies and the overload of requests for interaction can be alleviated by providing awareness technologies allowing others' to inspect your interactional preferences and to gain awareness of your activities [24; 47; 50].

Discussion

In this paper we have aimed to provide a principled debate of technological options for supporting the management of knowledge based on four knowledge discourses and found the following (See Table 1). The knowledge as *object* discourse inspired us to focus on supporting the managing knowledge through the production and distribution of information. The knowledge as interpretation discourse emphasized support for individual interpretive activities. The knowledge as *process* and knowledge as *relationship* perspectives help us appreciate the everyday accomplishment of knowledge work as distributed social processes of interaction or collaboration [93]. The knowledge as *process* discourse pointed towards supporting processes of collaboration and communication through, for example, telephones, email and workflow technology. The knowledge as *relationship* discourse complemented our conceptualization of technological options in that it points towards building and maintaining relationships.

Much of the debate of support for knowledge management has taken as its starting point the characterization of the relationships between data, information and knowledge [2; 17]. In our opinion there is a risk that a debate around the relationships between data, information and knowledge as the basis for ICT support would place too much emphasis on the representational aspects and thus focus on the objectification of knowledge. At the same time, it is clear that any ICT support for the management of knowledge will rely on representations, formalizations and the processing of data within computing environments — such is the nature of the beast. There is a need for a balanced debate where both the social and the technological issues are considered [91]. In such a debate, the images and perspectives, which we employ when considering technological options, will greatly shape our perceptions. In explicitly choosing a range of metaphors and perspectives when engaging in technology discourses, we can shape our attention concerning technological choices. The theoretical contribution of this paper has been to forward four perspectives on the management of knowledge and to apply those perspectives in a structuring of a discussion of support technologies. The conception and subsequent understanding of this technology relies on the complex relationship between the relatively simple internal functionality of optimizing multiple parameters resulting from users training the system and the meanings attached to the output by the community of users of this output. It is important that we recognize the need for a symmetrical debate between the ways in which technologies construct us and the ways in which we construct technologies. Clearly, ICT support will always involve codification, formalization, and externalization of knowledge. However, the perspectives we apply to reappraise uses of technology for the management of knowledge can and must shape the technology discourse. It is our hope that the four knowledge and the four technology discourses presented in this paper can be an initial step towards a more balanced debate of ICT support for Knowledge Management.

Knowledge as.	ICT support issues
Object	Supporting information distribution Information overload
Interpretation	Supporting interpretation and navigation Filtering and agents Information overload Digital traces of human activities
Process	Embedding collaborative structures Coordination mechanisms Structure overload
Relationship	Establishing and maintaining connections Mutual Awareness Interaction overload

Table 1: Examples of ICT support issues inspired by the four knowledge discourses

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