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Individualist and collectivist perspectives on knowledge in organizations: Implications for information systems research ☆

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ABSTRACT

Organization scholars differ in their understanding and application of the construct of "knowledge" in theorizing and empirical research. Over the past years, two perspectives have become prevalent in organization science. The *individualist* perspective assumes the locus of knowledge is people who learn, and that knowledge cannot extend beyond the physical limits of human beings. The *collectivist* perspective assumes the locus of knowledge is collective. Collective entities accumulate knowledge through forms of social learning. Boundaries of knowledge are drawn around social entities—groups, communities, networks, and organizational units, etc. Recent work in management and organization science has accentuated the differences, and argued against the widespread adoption of a collectivist perspective. This argument holds implications for information systems research. The current paper reviews selected contributions on the locus of knowledge, presents an argument for a combined collectivist and individualist perspective, and outlines future directions for information systems research. Drawing on two significant examples, I show that information systems research has a strategic role to play in greatly advancing this combined perspective.

1. Introduction

Over the last 20 years theories and empirical studies have explored the many facets of knowledge in organizations. The knowledge construct has made an inroad in a variety of subfields, including organization and management theory (e.g. Kogut and Zander, 1992), strategic management (e.g. Spender and Grant, 1996), organizational behavior (e.g. Hansen, 1999), innovation and technology management (e.g. Dewar and Dutton, 1986), and information systems research (e.g. Alavi and Leidner, 1999; Leidner, 2000). Scholars have become comfortable with and adept at using knowledge to explain and examine patterns of creating, thinking, planning, deciding, and acting in organizations. Research methods have also become increasingly suited to exploring a range of antecedents and consequences of knowledge in organizations (Schultze and Leidner, 2002). By dissemination through teaching, learning, and practice-oriented communication, knowledge also became part of a "mainstream vocabulary" of management (Newell et al., 2002).

While the knowledge construct is widespread in academic work, few studies have revealed or examined its fundamental assumptions. This creates two types of problem. First, a lack of transparency in assumptions makes it difficult to establish coherence between conjectures, theories, models, and empirical studies. When fundamental assumptions remain convoluted, follow-up work faces uncertainty in establishing the fit between research design, constructs, and theory. For example,

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a research model may contain "tacit knowledge" (or "tacit knowing," cf. Polanyi, 1966) but the definition and understanding of this construct and its variables strongly impacts on the choice of research design (Nonaka and von Krogh, 2009). On the one hand, if tacit knowledge is tied to implicit learning and unconscious routine problem solving, researchers may need to observe it in a laboratory setting where parameters can be controlled, or discern it from the interpretation of rich data gathered in longitudinal observation of behavior. On the other hand, if the research model suggests knowledge can move from tacit to increasingly explicit through reflection and communicated to others by speaking, drawing, or writing, qualitative interviews or questionnaires may indicate some aspect of its nature.

Second, when fundamental assumptions remain convoluted it may be difficult to build a cumulative or more comprehensive understanding of knowledge in organizations. Thus, scholars often lament that knowledge remains a very elusive construct in academic work. After more than 20 years of research in this area, it is hard to draw commonly agreed boundaries around the construct that would make findings from empirical research more generalizable, or pin down more reliable items for measuring knowledge. For example, there is strong and obvious incompatibility in assumptions between a research model that equates knowledge with information and information processing with cognition, and a model where knowledge is embodied (von Krogh et al., 1994).

In order to make progress in the theory and empirical study of knowledge in organizations, scholars should address these two problems by revealing and discussing their fundamental assumptions more extensively. As the examples illustrate, those assumptions can cover many different aspects of content (e.g. knowledge and information), process (e.g. knowing, information processing and cognition), and the locus of knowledge (e.g. individual or collective). Lately, a debate in management and organization science has drawn attention to the latter (Felin and Hesterly, 2007). The debate is among scholars who adopt two different perspectives: an individualist perspective that assumes the locus of knowledge in organizations is the individual; and a collectivist perspective that assumes the locus of knowledge is collective. As I show later, many take a combined view, which includes individual entities. The purpose of this essay is to present and respond to some select contributions to the debate, and show why a combined view on the locus of knowledge is needed. I also argue for the importance of information systems research for advancing the combined view. A conclusion is that theory development and research on knowledge in organizations is at the nexus of context- and artifact-oriented information systems research, as well as the individualist and collectivist perspective on locus of knowledge.

The paper is organized as follows. In the next section I present some contributions to the collectivist perspective and then discuss some important contributions to the individualist perspective. The subsequent section uses two examples to demonstrate how information systems research can foster a combined view on locus of knowledge in organizations. I show how a combined view can be instrumental to theorizing, exemplified by Alavi and Leidner's (2001) model of knowledge management, and how open source software (OSS) provides a research setting for the study of knowledge reuse by individuals and collectives (von Krogh and Spaeth, 2007). It should be noted that each perspective contains a plethora of fine-grained ideas, constructs, and variables that leads to further divisions within each. However, the purpose of this paper is not to provide a fully fledged analysis of the literature on knowledge in organizations (this has been done elsewhere—see Nonaka et al., 2006; Nonaka and von Krogh, 2009), but rather to analyze the locus assumption in the current debate.

2. The collectivist perspective

Since the early work of Winter (1987), Nonaka (1991, 1994), Kogut and Zander (1992), Grant (1996), and Spender (1996), scholars have taken an increasing interest in understanding knowledge and the surrounding processes in organizations. The reason for this interest is that knowledge has been shown to explain a variety of effects in management and organization science. For example, knowledge creation explains an organization's capacity to innovate (Schulze and Hoegl, 2006); knowledge sharing in networks relates to levels of cooperation between organizational units (Hansen, 1999), and stocks and flows of knowledge (e.g. patents, technology, expertise) explain firm performance (DeCarolis and Deeds, 1999). However, a closer examination of such work reveals ideas about knowledge that can be summarized as two perspectives: individualist and collectivist. The individualist perspective assumes the locus of knowledge is the individual, while much of what we think of as the "collectivist" perspective broadens the assumption to cover knowledge at collective levels. In the following section, I present some examples of the collectivist perspective.

For the last 20 years, much of the work that adopts a collectivist perspective has assumed the locus of knowledge is both collective and individual (e.g. Blackler, 1993). For example, at the individual level, knowledge provides people with the capacity to reflect, think, plan, decide, and act, and formulate and solve problems in the workplace. At the collective level, knowledge allows for communication, coordinated reflection, thinking, planning, decisions, and action. Knowledge allows groups, networks, communities, teams, and organizational units collectively to formulate and solve problems of relevance to the social unit. However, this simple-sounding, combined view of locus has given rise to considerable debate in management and organization science. Many propositions and models have been forwarded to explain how individual knowledge interacts with collective knowledge, and vice versa. According to Felin and Hesterly (2007), these contributions vary in the extent to which they consider the locus of knowledge to be individual or collective, and whether or not they take the individual seriously in theorizing.

Let us examine four examples of contributions to the collectivist perspective. First, Kogut and Zander (1992) provided an early exemplar of theory building, proposing that organizations are social collectives. Knowledge of organizations is

relatively observable, covering elements like operating rules, manufacturing technologies, or customer databases. Organizations should therefore be understood, in academic work, as "social communities" where individual and collective expertise is transformed into products and services through higher-order, organizing principles.[1] Organizations provide social communities for "voluntaristic action" by individuals, structured by such organizing principles, which extend beyond individual knowledge. Collective knowledge is found in relationships between people in the organization; it impacts on ways of organizing work and transferring knowledge between people and organizational units (see also Suchman, 1987). The organizing principles influence these relationships, and Kogut and Zander exemplify them by the knowledge displayed in an organization chart limited to arranging personnel and formal authority. Yet organizing principles need to be understood in a broader context, since new and informal relationships emerge through work; for example, a group where individuals contribute their knowledge might discover a new way of synthesizing a chemical. The organizing principles indicate what, why, and how this synthesizing process can be disseminated to other groups throughout the organization. Thus, a link is forged between individual knowledge and the space of action afforded through collective knowledge.

The second contribution, a solution to the problem of interaction between individual and collective knowledge, was proposed by Nonaka (1994) and Nonaka and Takeuchi (1995). Their contribution was twofold; first, to analyze knowledge on a continuum ranging from explicit to tacit, and second, to examine the interaction between the individual and the collective in processes of knowledge conversion. The conversion process consists of socialization, externalization, combination, and internalization (SECI) (Nonaka et al., 2006). I will return to these in more detail when developing a response to the individualist perspective. Here, it is important to mention that groups of people do not just learn individually from each other; they also engage in a creative process of enhancing collective knowledge, enabling the group to perform better through coordinated individual behavior. Collective (explicit and tacit) knowledge, in turn, also affects individuals, who increase their repertoire of action, problem formulation, and decision making. For example, researchers learn to apply a statistical toolkit, jointly developed and tested by many, to analyze their specific dataset. An important assumption of organizational knowledge creation theory is that individuals seek personal utility when selecting elements of collective knowledge to apply to their particular situation (von Krogh et al., 2000). Thus, a researcher may only choose those components of the statistical toolkit that are relevant for his or her analysis. In order for individuals to exploit collective knowledge for the task at hand, the organization needs to make such knowledge available.

The problem of individual–collective interaction in knowledge creation led Nonaka (1994), Hedlund (1994) and Hedlund and Nonaka (1993) to analyze a variety of organizational mechanisms that impact on the accumulation of collective knowledge. Nonaka (1994) suggested that organizations have a "knowledge layer" to which individuals and groups contribute, and from which they can extract existing collective knowledge. Nonaka et al. (2000) (see also Nonaka and Konno, 1998) suggested this knowledge layer consists of various assets at the organization's disposal, ranging from intellectual property (patents, trade secrets, copyrighted material), rules, procedures, and databases to values and norms that influence organizational behavior. Several other authors in strategy and organization theory adopted a similar view of collective knowledge as "knowledge assets" for the purpose of explaining the link between a firm's strategy and its performance (Teece, 1998, 2000; Boisot, 1998).

Third, some authors have understood knowledge as individual and/or collective distinction making, and this view also provides additional insights about locus. Tsoukas (2005), indicates that a theory of organization or organizing connects the loci of knowledge. He defines organizational knowledge as:

> The capability of members of an organization have developed to draw distinctions in the process of carrying out their work, in particular, concrete contexts, by enacting sets of generalizations whose application depends on historically evolved collective understanding (2005, p. 120).

This view resembles a prior construct of organizational knowledge as distinction making by organizational members and the organization (von Krogh et al., 1994). The notion of collective distinctions as organizational knowledge makes it possible to analyze how individuals make observations and identify data, information, decision-making situations, tasks, problems, and events, and to share these with others. For example, when managers want to analyze the positioning of the firms in an industry, they draw upon prior historical understanding of distinctions between the firm and its customers, competitors, suppliers, and so forth. Distinctions apply to attributes of the firms' products versus those of competitors' products. Distinction making allows managers to differentiate products based on market share, market growth, or their revenue generating potential. Distinctions enable individuals to organize their own observations and experience, and contribute their knowledge (distinction making) to data, information, and knowledge that exist beyond their own individual observations and experience. This view integrates two levels, by identifying distinction making as a process these have in common. The historical element of distinction making in both Tsoukas's (2005) and von Krogh et al.'s (1994) work points to a path-dependency in collective knowledge.

Fourth, the idea of knowledge as distinction making resembles Niklas Luhmann's (1989, 1990) theory of organization as systems of communications and decisions (see Hernes and Bakken, 2003). Luhmann's work is the most prominent example

[1] A large and distinct body of work emerged under the heading of "community of practice" or the social practice perspective on knowledge following on these ideas. For more, see Brown and Duguid (1991), Wenger (1998), and Fenwick (2008).

of distinguishing collectivist and individualist perspectives, and looking for organizational level outcomes without extensive discussion of individual psychology.[2] As a system, the organization exists in parallel to individuals (what Luhmann called "psychic" systems). Both systems have at their disposal processes that give them identity and set them apart from the environment, such as observing, communicating, or making decisions. Thus, individuals and organizations are autonomous: the knowledge of one system cannot determine the knowledge of the other. Yet both systems provide input to the other. Luhmann described this as "perturbations" caused by one system on the other. For example, organizations are "fueled" by the effort of individual organizational members. When you communicate using an organizational terminology or make decisions drawing on available data, information, and past decisions of the organization, you help to perpetuate that system's self-reproduction. Luhmann's view might seem somewhat unconventional to management and organization scholars, but it was quite effective for analyzing the breakdown of communication—for example, the inability of environmental lobbyists to influence political decisions, or of the law to impact on unethical decisions in business. According to Luhmann, some types of problem, where individual learning and knowledge do not enter into consideration at the organizational level, require distinct analysis of the autonomy, processes, and interactions of individual (psychic) and social systems. On the one hand, collective knowledge in this view is path-dependent, and may be to some extent immune to individual influence. On the other, individuals are autonomous, too, and decide to which organization, and thus which collective knowledge, they want to contribute. Both individuals and organizations are resistant to change.

The four contributions I have presented here all adopt a collectivist perspective, and all are concerned with locus and the interaction between individual and collective knowledge. Of the four, Luhmann's contribution makes the most distinct separation between individualist and collectivist perspectives. Next, I will discuss the individualist perspective, and some issues this raises.

3. The individualist perspective

In management and organization science, the individualist perspective on the locus of knowledge is often traced back to an early contribution by Herbert A. Simon (Simon, 1991). In this paper, Simon addressed where knowledge is stored in the organization, and who has learned it. In keeping with a so-called "cognitivist tradition" in the field[3], Simon viewed knowledge as an individual representation of a problem, decision situation, or an external environment (von Krogh et al., 1994) and proposed that all learning "takes place inside human heads." At the same time learning is a metaphor for organizational analysis. Thus, organizations "learn" through the learning of their members or by ingesting new members who have knowledge the organization lacks (Simon, 1991, p. 125).

Learning at the individual level is influenced by the organization and has consequences beyond what could be inferred by observing learning with isolated individuals. Simon proceeded to discuss various organization level antecedents and effects of individual learning. Learning by individuals occurs when they assume and adjust to the roles that constitute the organization. This means that the "learner is presented with an appropriate problem representation, and has to learn how to use it effectively. That is essentially what is involved when organizations, already formed, ingest members from an alien culture" (Simon, 1991, p. 132). Knowledgeable individuals who coordinate their efforts can create these representations, which can then be circulated to other individuals in the organization. Such representations may define goals, structures, resources, procedures, and roles in the organization, and so "simplify life" for individuals learning to perform their roles.

Organizational change becomes a matter of creating new representations for members to learn, while innovation in the organization results from ingesting people whose past learning deviates from the norms in the organizational culture. Most of the knowledge that can be attributed to an organization exists as individual memory, but some knowledge is also found beyond individuals, for example, in expert systems or procedures recorded in print.

Simon's insightful essay ventures beyond the field of cognitive psychology into the theory of organizations. He applies a metaphor of learning to bridge various levels of analysis and draws on years of solid research in human learning to generate new insights about organizations. He proposes that organization scholars should apply the "coherent language" of cognitive psychology to describe the mechanisms and processes of learning. However, the suggestion that there are "correct" organizational representations that function as templates for individual learning, requires one to accept the assumptions of cognitivist theories. A major issue with this is, first, that individual knowledge is limited as a problem representation; and second, that the proposition neglects more recent research in cognitive science pointing to areas such as implicit learning, embodied (neurologically-based), and tacit knowledge. When insights about phenomena such as embodied knowledge and implicit learning are applied to organizational analysis, one would expect problem or role confronting individuals to produce vastly different outcomes. In an alternative, connectionist theory rooted in neuroscience[4], individuals bring their own neurological state or past experiences to task and roles and in the process, create and shape them. Their interpretations of documents, procedures, and other elements of organizational memory is a mix of path-dependent states of experience and new stimuli from

[2] Although Niklas Luhmann's work was not discussed in Felin and Hesterly (2007).

[3] Cognitivism refers to a direction in theory and research that views cognition as a set of mental states, abstract representations, and symbols that can be manipulated.

[4] Connectionism refers to a direction in theory and research that views mental processes as emergent properties of interconnected networks of simple units, such as neurons. Connectionism focuses on the neurological conditions for knowledge, and is less concerned with representations and symbol manipulation (cognitivism). Hence, connectionism is often said to deal with the sub-symbolic level of mental processes.

the environment. Thus, their past interpretations are indistinguishable from their history of "movements in the world" (Varela et al., 1991).

Using the cognitivist metaphor of a computer in the vein of March and Simon (1958), just as software code is needed to run a computer, templates (e.g., tasks and roles) can be learnt by organizational members, enabling them to perform according to an assigned problem space. However, this metaphor has its limits. When somebody is hired to fill an HR role, the first thing to do is not to internalize representations, in the way a computer would need to compile a piece of software code. Rather, the new hire needs to attend to given tasks using a mix of personal knowledge, organizational role "representations," opportunities to imitate colleagues, or signals and cues from colleagues and managers. Organizational roles and tasks are emergent and will be influenced by individual experience, interest, knowledge, and other personal characteristics, as much as by context (e.g., colleagues, procedures, existing and new tasks, perceived problems, and opportunities to act).

Simon's essay is important to management and organization science because it forced contributors to the collectivist perspective to contemplate differences and links between individual and collective knowledge. I will return to this in the next section. Most importantly, however, it inspired what can be referred to as the "individualist perspective" on the locus of knowledge exemplified by two other prominent contributions. First, in a milestone contribution to the knowledge-based view of the firm (Spender and Grant, 1996), Robert Grant (Grant, 1996) accepted Simon's assumption of locus, and formulated two additional assumptions for his own work: that knowledge creation is an individual activity, and that the primary role of firms is the application of existing knowledge to the production of goods and services. Thus, an objective of research should be to understand the organizational processes by which a firm can access the knowledge of individuals. Against this background, Grant warns: "The danger inherent in the concept of organizational knowledge is that, by viewing the organization as the entity which creates, stores and deploys knowledge, the organizational processes through which individuals engage in these activities may be obscured" (Grant, 1996, p. 113). Organizational processes integrate individual, specialized knowledge through rules and directives, sequencing of tasks, and organizational routines, as well as group problem solving and decision making. Central to the argument is the idea that the cost of sharing knowledge between two individuals often outweighs the rewards. Organizational processes incent and create the context for the integration of individual knowledge, without the need to create costly common knowledge. Common knowledge includes language, symbolic communication, commonality of specialized knowledge, shared meaning, and recognition of individual knowledge domains.

Grant's essay raises two issues. First, analysis of the costs and benefits of knowledge sharing is critical because it allows us to understand how organizations produce services and products based on specialized knowledge, at varying levels of efficiency. Organizations have integration mechanisms contingent on cost/benefits and the complexity of the tasks at hand. However, accepting organizational knowledge as a construct is not the same as neglecting the role of individuals in creating, sharing, storing, or applying it. Individuals contribute their knowledge to the organization, and they need organizational processes for doing so. Processes ensure that knowledge is shared between individuals as needed to solve the task at hand (considering costs, benefits, and so on). Consider, too, the possibility that the organization contributes knowledge to the individual, in particular, when important knowledge for an individual's task performance is to be found in the organizational memory, not the memory of other individuals (Simon, 1991). Yet, how and to what extent do processes ensure that this knowledge is contributed to individuals (beyond individuals' building of common knowledge through group problem solving and decision making)? Answering these questions would mean taking a combined view of locus, individual as well as collective.

Second, it is beyond the scope of this essay to cover the many assumptions underlying cognitive theories and the possible consequences of importing them into a theory of organization. Yet, this raises issues of relevance to the field of organization as well as information systems. On the one hand, if we stick to cognitivism, integration mechanisms, such as rules or routines, form the templates an individual is confronted with at work and needs to learn. Learning in this context means improving representations of templates, and is a necessary condition for efficient organization. For example, a rule for solving problems is represented by the individual in the organization. Thus, when placing the locus of knowledge with individuals, we show their critical role in organizations and highlight the need to integrate their specialist knowledge through organizational processes. However, do we still fail to account for the individual differences that gave rise to the cost of knowledge sharing in the first place? Individuals differ with regard to their knowledge, but, for the efficiency of integration mechanisms, are similar in their propensity to represent templates.

Conversely, if we assume individuals' knowledge is embodied and tacit, their experience matters: individuals will differ in internalizing and "representing" templates, that is, integration mechanisms may in fact be arbitrary or inefficient in the face of individual heterogeneity. Consider the following example. Simon suggested that the vision and strategies of firms need to be formulated by top management, and then "implant[ed]... firmly in the hundreds of heads" (Simon, 1993, p. 139) throughout an organization. Individual learning of such representations enables the organization to behave in a coordinated manner and pursue a specific direction. A certain level of docility is assumed here, and the strategies need to be clearly defined (Simon, 1993). Yet, in a classical study, Guth and MacMillan (1986) showed that, while top managers of an organization may formulate clear strategies, middle-level managers often avoid implementing them. This was explained by middle managers' varying experience, leading some to reject the cause and effect relationships underlying these strategies (ambiguity). Another explanation is that middle-level managers often pursue their own interests and seek to protect their expertise or turf (see Amason, 1996, for a classical analysis; see also Hammond and Miller, 1985). Whereas in theory the solution to problems of integration and representation is to improve the clarity of messages, empirical evidence shows this may not always happen. Thus, at the extreme, the main cost to the organization may not accrue from creating common knowledge between

middle- and top-level managers, but in fact, from failing to do so. Perhaps the individualist perspective is not "individualist" enough in these instances. If people's knowledge and interests are heterogeneous, then how can knowledge of other individuals and the organization, and knowledge of integration mechanisms, be converted into knowledge that the individual can use to solve tasks and fill roles in an organization? Integration mechanisms thus represent a second-order knowledge problem.

Third, a recent important contribution to the individualist perspective was made by Felin and Hesterly (2007), who investigate the relationship between knowledge and value creation in organizations and demonstrate the need for an analysis of assumptions behind the knowledge construct. The authors highlight differences between the individualist and collectivist perspectives, and show that the Durkheimian (Durkheim, 1952) tradition of examining social facts and emergent phenomena at the level of the collective has been prevalent in theories of organizational knowledge, including the knowledge-based view of the firm (Spender and Grant, 1996). Methodological individualists in the tradition of Elster (1989) and Popper (1962) argue that collectives are made up of individuals, and so theories of organizations and other social phenomena should use individuals as the unit of analysis (Donaldson, 1990). The authors introduce the idea of "supervenience," based on the work of Kim (1984), among others, who describes dependencies and determinations within a structure composed of multiple elements. The following argument is made: collectivists assume downward causation from the collective to the individual, whereas individualists assume an upward causation from individuals to the collective.[5] One claim is that collectivists treat individuals as homogeneous. Thus, "no individual level, a priori knowledge exists without environmental stimulus and learning. That is, heterogeneity in stimulus, context, and environment determines differential individual and collective-level outcomes" (Felin and Hesterly, 2007, p. 202). Collectivists are particularly interested in the effect of organization on individuals' knowledge and skills, such as routines that determine individual behavior (Felin and Hesterly, 2007, p. 200), as well as the impact of collective-level knowledge on an organization's value creation activities. Thus, another claim is that collectivists assume individuals are infinitely malleable through organizational judgment, values, norms, and attitudes, or randomly distributed within the organization. As a metaphor for the individual, "malleability" describes the property of metals that can be hammered into other shapes without breaking.

Scientific findings, and the ontological and epistemological differences between the two perspectives, make a case for an individualist understanding of the locus of knowledge in organizations. Felin and Hesterley call for reversing the causality between individual and collective knowledge in the knowledge-based view of the firm. While the differences in epistemology and ontology may be known to scholars in management and organization science (e.g. Tsoukas, 2005), the discussion of scientific insights on human nature is very novel and warrants attention. The authors suggest that the collectivist perspective is currently challenged by the work by Noam Chomsky in linguistics (see, for example, Chomsky, 2000), who proposed that people have innate, a priori, individual-level knowledge that aids them in language acquisition. Felin and Hesterley proceed to discuss other work in cognitive psychology that adjusts or marginalizes the role of the environment in individual learning, and give primacy to innate knowledge or cognitive abilities. This research includes the study of infants' innate knowledge in other cognitive domains than language acquisition, and studies of twins separated at a young age who show remarkably similar cognitive abilities despite being brought up in different environments. The authors conclude that a priori, innate individual-level knowledge is a source of heterogeneity and thus impacts value creation.

Compared to the two other reviewed works, Felin and Hesterly's (2007) important contribution clearly presents the most far-reaching implications of adopting an individualist perspective on the locus of knowledge. First, future theory and research need to address the question of who creates and owns, and who captures, new value. These are crucial issues: knowledge-based advantages of firms are increasingly found in a few individual experts, and do not stem from knowledge that is widely distributed in the organization. An example is a small investment bank where a few senior partners would hold much of the know-how related to the investment process as well as information about customer relationships.

Second, akin to Simon's analysis, because of the locus of knowledge, Felin and Hesterley suggest future work needs to be more concerned with the mobility of individuals. Who leaves and who joins the organization, should be a prominent issue in organizational analysis, the study of which will bring more clarity to the sources of competitive heterogeneity.

Third, the discussion of the individualist perspective draws on an influential and fast-growing literature in cognitive psychology. Thus, future work needs to compare individual and collective effects when explaining organizational outcomes. For example, one question concerns the relative effect of knowledge assets (e.g., patents or technology) and individual expertise on the firm's economic rent in the industry.

Felin and Hesterly's work raises two issues for scholars interested in knowledge in organizations. First, assumptions about the locus of knowledge are relatively clear, the definition of knowledge needs to be explored further. For example, is knowledge to be understood in a cognitivist tradition or a more recent and connectionist tradition? How one defines knowledge impacts on theory construction and the design of empirical studies of innate knowledge and language acquisition (Westermann et al., 2009). Also, depending on the definition of knowledge, as discussed above, one might draw different conclusions regarding integration and other organizational mechanisms, such as training and incentives. For example, if people learn differently, given their innate knowledge, learning to perform a task in the organization may need on-the-job training rather

[5] Felin and Hesterly (2007) discuss ontological individualism, which is the thesis about individuals exhaustively determining social facts. For a recent analysis of this view, see Epstein (2009).

than reading or classroom lessons. Moreover, people's prior experiences with incentive schemes—for example, their individual career paths, or how they think their superiors perceived them in the past—might motivate them differently.

Second, this paper takes a broad and inclusive view of the collectivist perspective, suggesting that prior literature assumes that individuals are homogeneous, and refuting the idea that collectivists also include individual locus of knowledge in explaining organization level outcomes. This is a generalization that holds true in some cases (e.g. the work of Niklas Luhmann) but not in all. Let me revisit organizational knowledge creation theory as an example of a collectivist theory (Nonaka, 1994; Nonaka et al., 2006). A similar argument may apply to many other contributions (Tsoukas, 2003; Blackler, 1993; Alavi and Leidner, 2001; Merali, 2000; see also Hayes and Allinson, 1998). In organizational knowledge creation theory, individuals are considered an instrumental source of new ideas and knowledge. A variety of individual experiences, interests, aptitudes, commitments, tasks, language, or interpretations give rise to new ideas and collective knowledge (von Krogh et al., 2000). In a nutshell, the theory has evolved toward explaining the interaction between individuals and the collective in organizational knowledge creation, taking a combined view on locus. Knowledge exists on a continuum between explicit and tacit. It is understood as the capacity to formulate problems and to act on solving them, as well as an individual level of justified true belief (Nonaka and von Krogh, 2009). Individuals convert knowledge through externalization (move knowledge along the continuum toward explicit), such as articulating ideas, and through internalization (move toward tacit), such as learning-by-doing. New collective knowledge is created through individual input by combining existing elements. This latter process conforms to an individualist view of knowledge creation and innovation, and will be visible in group problem solving and decision making (Grant, 1996). An example of the latter perspective is McFadyen et al.'s (2009) bibliometric study of scientists in the field of biomedicine. Knowledge creation in this field is impacted by individual scientists' creative efforts and their affiliation and location in professional networks.

Organizational knowledge creation theory also proposes that collective knowledge can be considered tacit. Here, groups not only replicate prior task solutions and routines, but also spontaneously or systematically invent new action repertoires (Erden et al., 2008). Individuals in groups observe these repertoires and learn what works and what does not when initiating collective action. These observations remain a part of people's group-related experience, but it may not need to be articulated to them. Tacit collective knowledge at group level is expanded because of individual heterogeneity in formulating and solving problems or making decisions. Finally, socialization is very much dependent on people's preferences for interacting with others, again making a case for heterogeneity and rejecting, on theoretical grounds, a claim that the theory treats individuals as malleable or flexible.

Individuals shape organizations, but are also impacted by them. As the individualist perspective argues, it is often costly and in other ways challenging to enable individuals to share their knowledge, because of individual heterogeneity (see also Zárraga and Bonache, 2003). The fragility of the knowledge conversion process is a core problem of organizational knowledge creation theory. Fragility stems from the individual's need to justify their beliefs and observations in a group (Nonaka et al., 2006). Differences in personality, values, preferences, interests, experiences, or communication skills, pose a constant threat to collective action in the organization, and may cause it to break down. The assumption that people are docile must be reviewed. A potential criticism of much collectivist work is that it understands collective knowledge as a rigid, coherent, sustainable, and strong body of knowledge that can explain organization level outcomes. It may fail to devote enough attention to individual heterogeneity and its influence on the process of organizational knowledge creation. This is one area that shows why collective and individual effects need to be examined in a compound fashion. Questions that could be raised include: how much individual heterogeneity (variation in interest and knowledge) can be absorbed by the organization? How does rigidity of norms, values, and beliefs at the collective level impact on individuals' voluntary participation in knowledge creation? How much rigidity in collective knowledge can people stand?

In organizational knowledge creation theory, individuals contribute to collective knowledge through individual internalization and by combining their own knowledge with others'. At the same time, collective knowledge, ranging from explicit to tacit, is shared through socialization. Yet, these processes neither need to assume that individuals are infinitely malleable, nor that they are randomly distributed in the organization. In some studies of organizational knowledge creation, it seems that innovation springs from the reluctance of individuals to accept rules and routines (Leonard and Sensiper, 1998).

The distinction between collectivist and individualist resembles a divide between psychological and sociological explanations for knowledge creation. However, even a good sociology of knowledge may need to account for individual contributors.[6] At the end of the day, there might be more things in common between individualists' and collectivists' perspectives on organizational knowledge, than that which sets them apart. They share their mutual dependency on exploring organizational level outcomes of knowledge, at the very least.

4. The study of combined individual- and collective-level effects: the role of information systems research

I have argued that theory and research on knowledge in organizations need to cover both individual and collective loci of knowledge in a compound fashion. Moreover, I argue that what is referred to as the "collectivist view" expends effort on

[6] An example of the latter is Bruno Latour's (1988) study of the work of Louis Pasteur, which provides a biographical account of a scientist's work on enzymes, a brief history of nascent biochemistry, the technical innovation of pasteurization, and the social innovations benefiting public health. As Latour shows, the latter owe much to his political and social connections and influence.

understanding the multiple levels of interactions between individuals and collectives in explaining organizational outcomes. Next, I propose that information systems research plays an important role in examining the latter.

Contemporary theory and empirical research on knowledge in organizations (and thus the knowledge-based view) benefit from a stronger connection to research on information systems, as can be demonstrated by two examples. First, an examination of the loci of knowledge in organizations, and the possible outcome at organizational (and individual) levels, can be done concurrently by integrating the information systems literature with organization theory, as argued by Swanson (1987)[7]. More recently, Alavi and Leidner (2001) aimed to develop an agenda for theory and research on knowledge management systems. By reviewing a broad range of literature, ranging from organizational behavior and organization theory, to strategic management and information systems, the authors show how integration gives rise to new research questions at the individual level (e.g., the incentives that encourage their knowledge contributions) and collective level (e.g. what mechanisms are most effective in establishing an organizational memory). The authors note that for an individual's or a group's knowledge to be useful for others, it must be expressed so that it is interpretable by the receivers. This raises the question of how much "contextual," "background," or "common" knowledge is needed for two individuals to share what they know. Information systems research aims to help answer this question, and support research and theory on knowledge management at individual and collective levels. Thus, the authors embrace both individual and collective loci in developing a framework that links knowledge management processes (creation, storage/retrieval, transfer, and application) with the role of information systems. For example, knowledge creation at individual and group levels (e.g., SECI model) can be supported by the use of information systems, ranging from storage to communication systems (Alavi and Leidner, 2001, p. 117). Likewise, systems for storage and retrieval of information can strengthen organizational and individual memory.

Particular attention is given to how individuals transfer knowledge in a group. For example, a research model suggests that individuals transfer explicit knowledge to a group's semantic memory, and vice versa (Alavi and Leidner, 2001, p. 123). Here, collectives and individuals exert a mutual influence on each other. Drawing upon studies of organizational knowledge and information systems, the authors do not assume infinitely malleable individuals, but emphasize that transfer of knowledge from the collective must go through a personalized "re-creation" process in the mind of the individual (with an uncertain outcome).

The heterogeneity of individuals is used as a starting point for discussing formal and informal channels of communication that allow individuals to "re-create" knowledge. Using informal channels (e.g., electronic networks, social software), information systems can help individuals transfer knowledge beyond the reach of formal channels. One example is where individuals post broad requests, such as "Does anybody know a solution to my problem?" Research has shown that people are often unaware of what collective knowledge is "out there" or what others know that will be of value to their tasks and roles (Kogut and Zander, 1996). Moreover, while information systems can disseminate collective knowledge fast, at low cost, and foster its application by individuals (e.g., through intranets), information systems research has also accentuated the practical need for individuals to be aware that collective knowledge may decline in its usefulness or applicability (Alavi and Leidner, 2001, p. 122): "This underscores the need for organizational members to remain attuned to contextual factors and explicitly consider the specific circumstances of the current environment."

Alavi and Leidner's work demonstrates that by combining information systems research with organization theory the "divide" between individualist and collectivist perspectives on the locus of knowledge is overcome. Information systems research is important here because it specifically deals with how the artifacts of IT interact with individuals in producing organizational outcomes. Increasingly, the science of designing such artifacts (Pries-Heje and Baskerville, 2008) becomes a cornerstone in handling more effectively the challenges of knowledge in organizations, and thus needs to be more tightly integrated in organizational analysis (Zammuto et al., 2007).

Second, it was not always obvious to those of us whose view of the problems of knowledge is drawn from management and organization theory, that information systems (and even their development) enable specific ontologies and new research settings via which unprecedented observations can be made of individual and collective-level knowledge in the making. Let me give an example. About 10 years ago, social scientists from various fields became interested in the growing phenomenon of open source software research. In particular, the tension between existing theories of organizational level outcomes and the empirical phenomenon drove the search for new explanations (von Hippel and von Krogh, 2003). Lee and Cole (2003) argued extensively why open OSS projects represent an appropriate but unconventional setting for examining various facets of organizational knowledge creation. As part of a larger project to understand the innovation process behind open source software, a group at the ETH Zurich (Stefan Haefliger, Sebastian Spaeth, Matthias Stürmer, and myself) became interested in the reuse of knowledge and technology. Our research question was: Once knowledge is created, what conditions increase or decrease the extent to which it is reused across space and time? Prior work had established that knowledge and technology reuse had a strong impact on the economics of innovation (e.g., Markus, 2001; Majchrzak et al., 2004), and in particular, the efficiency of software development (Kreuger, 1992). Yet no research was available on the practices (if any) of knowledge reuse in OSS development. In an initial phase, we decided to focus on what, why, and how individuals reuse knowledge in their development practices. We conducted case studies of six different OSS projects combining various types of data, including software code, email communications, documents, and interviews, and performing quantitative and qualitative analysis. The

[7] See also Galliers' (2003) call for information systems to be viewed as a trans-disciplinary field of study, and the earlier call by Galliers et al. (1997) for a partnership between organization theory and systems thinking.

evidence showed much more reuse in the OSS projects than originally anticipated from a review of prior research into commercial software innovation. The study also revealed several reasons for this behavior; individual developers reused software to get rid of boring or cumbersome programming tasks and move onto more "technically sweet" problems. We also found that, due to limited resources, developers reused to *individually* economize the development task. They freely applied available algorithms, software, and other types of knowledge that fitted with the artifact they were creating. Their decisions to reuse were partly dependent on their information about available knowledge, and partly on their own skills and expertise. Thus, in this study, we could identify an individual locus of knowledge, explaining what technology is developed within the project by its participants, and which knowledge and software would be reused from other projects (Haefliger et al., 2008). An obvious step is to test the research model on a larger sample OSS project.

While working on the project, a new research question emerged: Does the reuse of knowledge and technology lead to a specific dynamic of knowledge creation in the OSS movement (an organizational level outcome)? Instead of pursuing this question by replicating our prior study, which originated in the behavior of individual developers, we teamed up with other scientists interested in complex social systems. In this project, the locus of knowledge "became" collective. We gathered data on the reuse of software packages in Debian Linux.[8] Knowledge creation in this distribution can be understood as a process of combination (Nonaka, 1994): adding, linking, and removing software packages by individuals and projects that to a varying extent reuse existing packages running with the Linux operation system. We constructed a network between such packages and examined it over time.

The pattern of knowledge creation that resulted from our analysis could not have been revealed by the original research model. First, the number of incoming packages to which more than a certain number of packages points obeys Zipf's law (Zipf, 1949) over four time periods examined (e.g. the frequency of a package is inversely proportional to its rank). Zipf's law is typically used in the study of the evolution of languages and identifies occurrences of specific words. Second, the study found proportional growth in package reuse. This means the number of links that already lead to a package, in other words reusing it, determines the growth of the number of new links made (Maillart et al., 2008). Thus, knowledge creation at the collective level proceeds with its own dynamics, which cannot be successfully explained by investigating the reuse behavior of individual developers. In terms of supervenience, this might mean causality is reversed from the collective to the individual, who to some extent abides by the dynamics of the collective when it comes to knowledge creation (e.g. many packages vanish if they are not collectively reused over time). The study generates a great number of new research questions that also have implications for a research model of reuse behavior assuming an individual locus of knowledge. For example, what characteristics of knowledge and technology—in this case, specific software packages—do developers consider when they decide to reuse? Or what knowledge creation dynamics at the project level inform individual choices? Without an IS-enabled research setting, a combined research agenda of individual- and collective-level effects on innovation would have been difficult (perhaps even impossible) to formulate. The example provides support for what I claimed earlier, namely that individualist and collectivist perspectives on the locus of knowledge are mutually dependent in developing theory and conducting empirical research. In a broader sense, as Kogut and Zander (1992) pointed out, knowledge resides in relationships within organizations. This collective knowledge is important to exploit business opportunities by replicating a technology, service, or product across locations, and it extends beyond individual knowledge, interest, and agendas. The reuse of collective knowledge is absolutely critical to the economics of modern organizations. Yet, memory located in individuals is elusive, and depletes quickly with the turnover of organizational members. Information systems allow knowledge to be stored, mediated, searched, and reused at lower cost.

Information systems research represents a new frontier for exploring the opportunities and limitations of each perspective. Recent work on social software or open source software, user innovation, and electronic communication, shows the heterogeneity of individual knowledge, and people's individual contributions to collective knowledge. OSS development, for example, works because people use simple rules of coordination and integration that allow them to contribute their personal knowledge at low cost (see Grant, 1996). Here, information systems research provides transparency about what individuals really contribute, but it also allows us to investigate the dynamics of very large and complex knowledge creation efforts at the collective level.

5. Implications and conclusions

This paper analyzes some contributions to the recent debate on individualist and collectivist perspectives on the locus of knowledge in organizations. The strengths of the individualist perspective in generating a set of pertinent research questions have been clearly demonstrated. However, individualist scholars have tended to overemphasize social and organizational knowledge in the collectivist perspective, choosing to ignore that several contributions explicitly deal with the interactions between individual and collective levels.

In order to advance our understanding of knowledge in organizations, we should embrace both the individual and collective levels, drawing on new insights from our field, as well as adjacent disciplines such as psychology, economics, and sociology. Information systems research plays a prominent role here because of the interest in the interactions between

[8] Started in 1993, this is one of the largest, oldest, non-commercial, and fastest growing Linux distributions (474 packages in 1994, more than 18,000 packages in 2007).

individual and collective knowledge and the role of information systems in producing outcomes at organization level. For it to continue to be of value, and to strengthen its impact on the ongoing "knowledge debates" in management and organization science, it seems to me that a trans-disciplinary approach, combined with a focus on IT artifacts, may be quite useful (Galliers, 2003).

The design of artifacts that allow knowledge to be created, stored, shared, or used represents an interesting and important research focus in understanding individuals' and collectives' knowledge and their interaction. The nature of IT artifacts has traditionally been underplayed in much of the theorizing in management and organization science (see also Orlikowski, 1992), yet the design of the artifact itself deserves attention because of the role it plays in knowledge management activities (see for example Salazar-Torres et al., 2008; Meso et al., 2006). In this respect, quasi-experimental research designs hold great promise for information systems discipline. At the same time, to be of value to the debate on knowledge in organizations, information systems research needs to deliver a comprehensive understanding of the personal and individual context in which information systems are embedded (see current debates in King and Lyytinen, 2006). A pure focus on the IS artifact and how to design it may miss out on important consequences that the design process holds for knowledge in organizations. For example, while it might be good to know the design criteria for a repository of reusable information, the actual effect of implementation on individual and team work needs to be explored. This calls for a broader set of research designs and methods, including case studies, ethnographies, biographical studies, and the like.

In this paper, I have aimed to show that academic work on knowledge integrates rather than separates debates and perspectives. Theory development and research on knowledge in organizations is found at the nexus of context- and artifact-oriented information systems research, as well as the individualist and collectivist perspective on locus of knowledge.

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