# The emergence of learning communities: a conceptual analysis

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## Abstract

A central issue in theories of organizational learning concerns the relation between knowledge of individuals and knowledge at the level of an organization. 'Communities' form a crucial intermediate level, in which knowledge links between individuals are achieved, and which then somehow form the basis for organizational learning. Hence the importance of the study of such communities. The focus of this paper is on communities for exploration rather than exploitation. Exploration requires diversity of knowledge and skill, but there must be sufficient mutual understanding and commitment to utilize the opportunities of diversity. This paper focuses on the question how that can be achieved, in terms of a shared system of meanings.

## Introduction

A central issue in theories of organizational learning concerns the relation between knowledge of individuals and knowledge on the level of an organization (Cohen 1991, Cook and Yanow 1993, Weick and Westley 1996). Weick (1991) proposed that organisational learning has possibly taken place when an organisation shows the 'same reaction to different stimuli', whereas individual learning is in the classical psychological literature defined as 'different reaction on the same stimulus'. What is not satisfactory in this view is that it does not take into account that learning can occur without visible change in actions. Learning can yield a basis for potential rather than actual, observable action (Huber 1996). However, this view may help in suggesting that organisational learning is the process of acquiring common knowledge, which includes the process of accepting and validating individually acquired knowledge as useful (Duncan and Weiss, 1979).

Groups and communities may, then, form a crucial intermediate level, in which knowledge links between individuals are achieved and thus common knowledge is acquired. The central purpose of this paper is to further analyse this intermediating role of communities in organisational learning.

In the literature on learning, a distinction is made between first and second order learning (Hedberg, Nystrom and Starbuck 1976, Fiol & Lyles 1985) or, equivalently, between 'single loop and double loop' learning (Argyris and Schön 1978). The first is learning to do existing things better (more efficiently) and the second is learning to do new things (from a new perspective). This is also connected with the notion of 'parametric' change (Langlois and Robertson 1995) as opposed to 'architectural' change (Henderson & Clark 1990). The Austrian economist Hayek distinguished between two kinds of 'spontaneous order': the first kind entailed the operation of rules, the second kind entailed the change of those rules. Holland (1975) and March (1991) distinguished between 'exploitation' and 'exploration'. The first entails efficient use of existing competencies and the second the development of new

ones. Exploitation is required for firms to survive in the short term, and exploration is required to survive in the long term. Thus, the literature states that in order to survive now and later the firm must perform both.

This entails a paradox. Exploitation requires the maintenance of existing identity, knowledge and practices, with a certain amount of control and co - ordination, in a 'dominant design'. Exploration requires their change, with a loosening of control and co - ordination. Exploitation entails a danger of 'inertia' that blocks exploration. First order learning entails improved exploitation, and second order learning entails successful exploration. How can one resolve this paradox of stability and change? The capability to balance exploitation and exploration is perhaps the greatest challenge and most important task of management (Nooteboom 2000). A crucial question thus is how the paradox can be resolved.

'Communities of practice' are currently understood as groups that are oriented towards exploitation in a shared practice (Brown and Duguid 1996). However, they do not seem to include exploration, which entails a more or less radical transformation of common practice. 'Epistemic communities' ( Steinmuller 2000; Haas 1992; Cowan, David and Foray 2000) are commonly defined as groups or networks of people who perform explorative learning. In this paper, we focus on exploration.

For this paper, we prefer to use the term 'communities of exploitation', rather than 'communities of practice', and 'communities of exploration' rather than 'epistemic communities'. The reason for this is that we do not want to commit ourselves a priori to any difference in emphasis on practice or epistemic knowledge between exploitation and exploration. In exploitation, practice is based at least partly on epistemic knowledge. According to the theory of knowledge we will employ, exploration is based on practice. While communities of practice are focused on exploitation, they may break out into exploration. If epistemic communities are focused on exploration, they may consolidate into exploitation (Nooteboom 2000). According to ancient Greek terminology, in 'episteme' the emphasis is on declarative knowledge, or know-that and know-why, while in 'techne' the emphasis is on procedural knowledge (Cohen and Bacdayan 1996) or know-how. Both may be involved, with different emphases, in both exploitation and exploration.

Explorative learning requires diversity of knowledge, which may be combined into something new, in Schumpeterian 'novel combinations'. The conditions under which this happens form the subject of this paper.

We proceed as follows. First, we discuss a number of basic theoretical issues: a theory of  knowledge and learning, social identity and social dilemmas, the role of trust, and a conceptualisation of the multi-level problem. Next, we give a detailed analysis of how communities for exploration might work. The focus is on how to establish sufficient commonality of understanding and communication, while utilizing diversity of knowledge. Here, we discuss network structure, types of cooperation, foundations of alignment, epistemic criteria, and the role of embeddedness.

**Theoretical issues**

**Learning, diversity and cognitive distance**

In order to proceed, we need to specify our theory of knowledge. In research in psychology (Doise and Mugny 1984), in organisational decision making (Eisenhardt, Kathway and Bourgeois 1997; Fiol 1996) and in organisational innovation (Nooteboom 2000, Kanter 1988), diversity of knowledge or functional diversity

(Schneider and Northcraft 1999) is considered a necessary condition for explorative learning. Diversity is needed for Schumpeterian novel combinations to emerge. Innovation is thus perceived as the combination and integration of already existing, diverse parts of knowledge into something new.

From the literature, we adopt the perspective of social constructivism. It is based, among other things, on the 'symbolic interactionism' of G. H. Mead, and was introduced to the organizational literature by Weick (1979, 1995), with his notions of 'enactment' and 'sensemaking'. According to this view: '(People) construct, arrange, single out and demolish many "objective" features ... unrandomize variables, insert vestiges of orderliness, and literally create their own constructs' (Weick 1979).

Knowledge is based on 'mental models, frames or schemata' (Johnson-Laird 1983) or categories (Nooteboom 1992, 2000). Here we adopt the term 'frames', because 'categories' may sound too cognitively rational, while we want to include values and emotions. Mental frames enable but also constrain individual perception, interpretation and evaluation. They create but also limit 'absorptive capacity' (Cohen & Levinthal 1990). They develop from interaction with the physical and social environment. Individual frames constitute individual absorptive capacity, and shared frames, connected with a shared language for communication, in the context of organizational structures, constitute such capacity on the organizational level.

From this view of knowledge it follows that to the extent that people have developed their knowledge in different environments, and have not been in communication with each other, cognition (in the wide sense of perception, interpretation ane evaluation), will differ: there will be greater or lesser 'cognitive distance' (Nooteboom 1992, 2000). Thus, cognitive distance is a relational concept. Cognitive distance yields both an opportunity and a problem. The opportunity is that contact with others gives us a possibility to escape from the myopia of our personal cognitive construction, by profiting from the different insights of others, based on different experience. In other words: learning is inherently social. A problem, however, is that the greater the cognitive distance, the more difficult it is to cross it, i.e. to understand the actions and expressions of a partner. The difference between cognitive variety and cognitive distance is as follows. Variety refers to how many different systems of mental frames there are, and distance refers to the difference between any two of them.

In a discussion of knowledge, we must turn, at least briefly, to the well-known distinction between tacit and codified knowledge. Our view is that on some level, absorptive capacity is inevitably and ineradicably tacit (Nooteboom 2000). In other words, it can never be completely codified. Thus, there is always a mix of tacit and codified knowledge: codified knowledge transferred from others is embedded in largely tacit absorptive capacity, which is personal to some extent, yielding some cognitive distance, and thereby meanings between communicators are never identical, but more or less similar. That is a good thing, because it is by such differences that we can learn from each other.

A central task of organizations is to create shared mental fames, to enable shared perception, interpretation and evaluation, for the sake of goal attainment, coherence, effectiveness and efficiency. Thus, organizations are seen as 'sensemaking systems' (Weick 1979, 1995), 'systems of shared meaning' (Smircich 1983), 'focusing devices' (Nooteboom 1992, 1996), or 'interpretation systems' (Choo 1998). In other words, for the sake of exploitation, organizations must limit cognitive distance.

The mental frames of perception, interpretation and evaluation, lying at the basis of shared meanings, are closely associated with the notion of 'culture'. Schein (1985) defined culture as basic assumptions and beliefs, which form the basis for values, which produce overt behaviour and artefacts (including symbols of status). Others prefer to define culture as including the surface phenomena of symbols, rituals, myths, but then we can say that underlying categories of perception, understanding and evaluation form culture's 'deep structure'. In communities within an organization, such culture is more specialized, and 'tighter' than on the organizational level.

When in an organization or community people interact closely for a long time, with limited outside interaction, cognitive distance will be reduced, in a process of mutual cognitive and affective identification, yielding shared or at least more or less similar mental frames. This is likely to happen in communities oriented primarily at exploitation, such as communities of practice. The advantage is great mutual understanding, with a great deal of shared tacit knowledge and language, and trust. Together, these enhance efficient exploitation.

The disadvantage is a reduction of cognitive variety and distance, yielding reduced exploration. There is a danger of collective myopia, whereby novel outside opportunities and threats are not perceived. To offset this, one needs outside contacts, at sufficient cognitive distance, and with sufficient variety, to avoid myopia. This is the priciple of 'external economy of cognitive scope' (Nooteboom 1992).

**Social identity and social dilemmas in cooperation**

It is crucial not to restrict the analysis to issues of knowledge, and to include issues of cooperation. The relation between individual and community, and the role of identification, have been studied in social exchange theory. It claims that an individual makes a cost-benefit analysis in order to estimate the value of the contributions. But then, Hardin's 'Tragedy of the Commons' (Hardin 1968) entails that cooperation has two perspectives: a personal and collective perspective.

 '*In this dilemma, cattle herders must restrict their use of a commonly shared grazing land in order for the land to remain productive. However, it is in the short-term self-interest of any individual herder that all other herders limit the number of cattle they grace while that individual herder does not. When all of the herder rely on others to restrict usage but don't restrict their own usage, the grass becomes overgrazed, the cows die, and the benefit disappears. The dilemma occurs because no individual herder has any short-term incentive to forego the immediate benefits that the commons provides*'

Social identity theory and the theory of social dilemmas specify three different problems when people cooperate, especially under the condition of cognitive diversity (Schneider and Northcraft 1999):
1. Social identity theory states that people prefer to work together with similar others who have similar *values, preferences, interests (*Schneider and Northcraft 1999). Therefore a common frame of reference is considered necessary for learning in teams (Boland and Tenkasi 1995). However, at first such a common frame of reference cannot be assumed to exist.

2. Secondly, the question is also what exactly is meant by a common frame of reference. Does this refer to values how to cooperate or values of justified knowledge?
3. The theory further suggests that people with functional diversity are likely to differ in their communication and interaction processes (Eisenhardt., Kathway and Bourgeois 1997, Donnellon 1993). In particular, the question is how to deal with power differences that are related to diversity in knowledge and in position and role in the community or in the wider organization.

These insights yield an elaboration of the problems associated with cognitive distance. Since these three issues are identified as possible barriers for explorative learning, communities of exploration should deal with them. Explorative cooperation must be investigated along the three dimensions of differences in values, preferences and interests. As the theory of social dilemmas states, a distinction should be made between (short term) individual goals and (long term) collective goals (Schneider and Northcraft 1999). The question that we address is how the processes of formation and maintenance of a functionally diverse group for explorative learning can be conceptualised in the light of the barriers indicated above.

**Multi-level scripts**

As suggested, communities form a crucial intermediary level between individual and organizational learning. First, from our perspective of social constructivism, people need interaction to learn. So, the basic unit of organizational learning is a group. Now, suppose that a explorative community arrives at a fundamentally new practice, how does it relate to organizational learning? How can explorative learning on the group level yield explorative learning on the organizational level?

To help in the analysis of this, we employ the notion of scripts. Originally, the notion of scripts was proposed on the level of personal mental constructs (Abelson 1976, Shank & Abelson 1977). A script is simply an ordered structure of sequential and parallel component activities called 'nodes' in the script. The classic example is a restaurant script, which orders component activities of entry, seating, ordering, eating, paying and leaving. In the innovation of a self-service restaurant the order is changed: entry, selection, paying, seating, eating, leaving. An important feature of a mental script is attribution: in a relevant context the observation of one node may trigger the entire script in the mind, and unobserved nodes are attributed to the context. This is efficient, in pattern recognition, but can yield prejudice. This elaborates the notion of absorptive capacity: one can absorb what one can fit into a relevant script. Someone not familiar with the self-service script may sit first and fail to get food.

We propose to employ a hierarchy of scripts to conceptualise the multi-level problem (Gioia and Poole 1984, Nooteboom 2000). On the organizational level, communities form a node in an organizational script. The activities within such a community are, in turn, ordered by a community-specific subscript. Individual participants in the community have their personal, sub-subscripts. Only on that level are the scripts mental. The connection between individual and collective practice and cognition operates through linkages in a hierarchy of scripts. Higher level scripts are not in themselves mental, but may be isomorphic to mental scripts, in the sense that they can both be rendered in terms of scripts. Individual members of the organization have mental representations of the part of an organizational script that is relevant to their role. These are not automatically the same between different people. Part of the

task of an organization is to have sufficient similarity of mental representations of organizational scripts, or parts thereof, for organizational exploitation to function. Here we again find the task of the organization as a 'focusing device'. This focus, of shared mental scripts of structures of collaboration, is especially tight in communities of exploitation. The question then is what happens to such scripts in explorative communities.

Following Nooteboom (2000), we propose that exploration on the organizational level may proceed as follows. Communities of exploitation are allowed to vary their practices only within certain constraints needed to maintain the architectural integrity of organizational scripts, which is needed for exploitation. When a novelty emerges that no longer fits the superscript, the community may be allowed to pursue further development in separation from it. Here, a community becomes explorative. For example, one can think of the 'skunk works' in 3M company. Here groups are allowed to break out from organizational scripts to pursue exploration. When they are not allowed to do so, they may do it surreptitiously. Next, when the novelty is proven to have relevant value for the firm, and it can at the same time be shown what constraints in organizational architecture prevent it from achieving its full potential, motivation may arise for organizational exploration, in the form of novel architectures.

*Here, one is reminded of the case of INTEL, where a community developed hidden activities in (unobserved) conflict with explicit firm policy (Stoelhorst 1997). When it turned out to be successful, this was recognized by the management, who announced that they would step down since they had imposed a counterproductive strategy. The communiy, and others, argued, however, that if management had the wisdom to take that view they should stay on.*

We propose that a similar process occurs on the lower level of communities. Here the nodes are individuals, with their mental scripts. To proceed towards exploration, those nodes must be allowed to connect with nodes of outside scripts, to experiment with novel combinations. For exploration, such novel combinations must be allowed even if they do not fit in the script of the community. That is how we understand communities of exploration. But then there is a need to re-vamp the community script. Variety of connections between nodes can be achieved by outside linkages, or by personnel turnover, with people coming in from different, outside scripts (March 1991).

The intermediary function of communities in organizational learning can be summed up with the following propositions:

*Proposition 1: Communities are needed because learning is social, on the basis of interaction.*

*Proposition 2: For exploitation, cognitive distance must be sufficiently small, on the basis of mutual identification of mental frames. This is needed for efficient sharing and coordination of knowledge, and for trust.*

*Proposition 3: For exploration, cognitive distance and variety must increase. This must be allowed even if misfits arise with respect to higher level organizational scripts. The question arises how relational risk is governed if identification-based trust is absent.*

*Proposition 4: When explorative communities produce succes, and it becomes apparent that in existing organizational scripts potential for the full realization of innovative potential is blocked, this can provide a condition for architectural change, and hence exploration, on the level of the organization.*

After our exposition of conceptual issues we turn to a more detailed analysis of explorative communities. Here, we will look at how epistemic communities are defined in the literature, and we will assess their explorative potential

## Communities of exploration

### Network structure

As defined by David, Foray and Steinmueller (1999), epistemic communities engage in transdisciplinary and/or transfunctional activities, at the interstices between them. In contrast with communities of exploitation, they are not organized around a common discipline or practice but around a common topic (David, Foray and Steinmueller 1999, Lissoni and Pagani 2001). Such communities are typically organized in networks. In the literature, different network structures can be identified.

Network structure can be dense or sparse, depending on the number of direct connections between the members. With n members, the maximum number of bilateral connections, and hence maximum density, is n(n-1)/2. To the extent that structure is sparse, there are structural holes (Burt 1992). Some actors may have more 'centrality' than others, with more connections than others, thereby spanning structural holes. Ties between members may be strong or weak (Granovetter 1982). We propose that the strength of ties has several dimensions: frequency of contact, durability of contact, diversity of contacts (flow of goods, money, knowledge, staff, and other resources), symmetric or asymmetric dependence due to specific investments, and (emerging) mutual identification. Note the connection between specific investments and durability: to recoup specific investments, a certain durability is needed. We expect that different patterns of density, centrality and strength entail different properties for exploitation and exploration.

Industrial networks are often stabilized structures of cooperation. They entail much division of labour. The structure of this network is sparse, with many structural holes. Participants have reached a high efficiency in agreements concerning the distribution of credits or rewards for output (David, Foray and Steinmueller 1999, Kreiner and Schultz 1993). Network structure is not necessarily centralized. However, in a principal-agent setting there may exist an authoritative hierarchy within the network, leading to stabilized patterns of cooperation, with implications for the type of cooperation. Here, centrality entails technological brokerage (Hargadon and Sutton, 1997). One party is the central coordinating spider or the technological broker in a web of various network members.

This network structure is to be described as 'private' (Krackhardt 1999), since the network members are not closely related to each other. In terms of strength, ties are specialised (in one or few dimensions), frequent but not necessarily durable. In classical buyer-supplier relations, the primary aim is maintenance of independence and flexibility, with an emphasis on low-cost efficiency. There, contact is arms-length, often rivalrous, with possible conflicts of interest, limited dependence, limited

specific investments, limited identification and limited trust (in the strong sense discussed above).

In prolonged interaction, identification and cognitive distance may decrease, and then loss of explorative capability arises: '… this efficiency gain may be offset by a loss of research variety if the stability of the network relies upon a particular division of labour among participants'(David, Foray and Steinmueller 1999:321). While such structure has been called an epistemic community, probably in the sense of having a shared knowledge base, it may not be an explorative community.

An alternative view of network structure in epistemic communities, grounded in groups-research in innovation, assumes a dense network between equals (Purser et al. 1992). Of course, here also there is a division of knowledge. However, the network is considered as a collective structure (Weick and Roberts 1993) with shared, highly decentralized communication patterns. It is assumed that there is more than only local interaction between some neighbours in a network, in direct linkages. Knowledge about the structure of the network itself is shared. Moreover, the group as a whole is perceived as a learning system (Salomon and Perkins 1998: 5):

*'Here it is not necessarily the case that one agent is helping another to learn. Rather, the focus falls on a collective agency that as a collective acquires more knowledge, understanding or skill, … A business organization develops internal procedures, based on some commonly held tacit assumptions, that meet customer demands better and more quickly. In such cases, the agreements are not stated, the procedures are not executed, and perhaps not even overseen, by any one individual, but they advance the performance of the organization. In sum, the group constitutes a collective learning system, a system that will function better or worse as a learner depending on how well its structures address critical conditions of learning'.*

In this view the structure itself supports cooperation. Weick and Roberts (1993: 360, 363) try to specify how this works. They define a collective structure as follows:

*'the word "collective", unlike the words "group" or "organization", refers to individuals who act as if they are a group. People who act as if they are a group interrelate their actions with more or less care, and focusing on the way this interrelating is done reveals collective mental processes that differ in their degree of development'. Under the condition of a collective structure 'they [people] construct their actions (contribute) while envisaging a social system of joint actions (represent), and interrelate the constructed action with the system that is envisaged (subordinate)'*

In other words: people in a collective structure apply a type of censorship to themselves. They 'voluntarily' bear the other in mind, as the following description of the behaviour of a bos'n who is responsible for deck operations (starting and landing) on flight decks shows (Weick and Roberts 1993:370):

*'This bos'n, who is responsible for the smooth functioning of deck operations, gets up an hour early each day just to think about the kind of environment he will create on the deck that day, given the schedule of operations. This thinking is individual mind at work, but it also illustrates how collective mind is represented in the head of one person. The bos'n is dealing with collective mind when he represents the capabilities and weaknesses of imagined crewmembers' responses in his thinking, when he tailors*

*sequences of activities so that improvisation and flexible response are activated as an expected part of the day's adaptive response'.*

Thus, in this view, the structure which somehow influences individual behaviour determines cooperation. In terms of scripts: there may be different individual mental representations of the collective script. There may be special roles (the bos'n) to form or affect the representation that other members have, in other words, to guide sensemaking.

We want to distinguish between density and strength. A network may be dense but without weak ties, and sparse with strong ties. Furthermore, terms such as 'collective structure' and 'equals' are too vague for our purpose. Does 'collective structure' entail density, centrality, or strength of ties? Presumably, 'equality' refers to some form strong ties. But does this refer to balance of power, symmetric dependence, or to shared mental frames? Does it entail diversification of contact, durability, or frequency?

In more recent developments in industrial networks, members engage in more durable relations, with mutual dependence, and perhaps trust. Here, network structure is till sparse, and there often is centrality, with a main buyer in the hub. However, ties tend to be stronger, in terms of diversity and duration of contact. This is aimed less at low price and more at quality and innovation by pooling complementary competencies, for which specific investments and a degree of mutual openness are needed, supported by some degree of trust  (Nooteboom 2002a).

**Types of cooperation**

Another issue in the literature on epistemic communities concerns the type of cooperation. Three levels of cooperation are distinguished (Nunamaker et al. 2001).

The first level is described as collective effort, with people working on their own, with a group result as the 'sum' (whatever that may be) of individual efforts. A second level is described as co-ordinated effort: people still work on their own but their individual effort is coordinated in a sequential fashion. There are certain points in the course of collaboration where some experts withdraw and others come in. The result of the whole group depends on individual performance plus coordination. There may exist sequential interdependence between the various activities. This type of cooperation mirrors the descriptions of cooperation in industrial networks (Lissoni and Pagani 200; Hakansson and Snehota 1995 in: Araujo 1998*)*. A third level of cooperation is described as concerted effort: the effort of all members must be performed in synchrony. There may be reciprocal or pooled interdependence. Lazaric (2002) specifies reciprocal interdependence as taking the form of 'delimitation' and 'validation' of knowledge within the epistemic community. She conceives these activities as the most essential characteristics of an epistemic community. Here, cooperation entails a concerted effort in order to develop an integrated solution through jointly validated contributions of group members under the condition of a collective structure.

Most of this fits with the notion of a collective script, introduced above. Nodes (component activities) are connected in the script for reasons of sequential, reciprocal and pooled dependence.

 Haas *(1992:3*): gives the following definition of an epistemic community:

*'An epistemic community is a network of professionals with recognized expertise and competence in a particular domain and an authoritative claim to policy relevant knowledge within a domain or issue-area (...). This network has (1) a shared set of normative and principled beliefs, which provide a value based rationale for the social action of community members; (2) shared causal beliefs, which are derived from their analysis of practices leading contributing to a central set of problems in their domain and which then serve as the basis for elucidating the multiple linkages between possible actions and desired outcomes (3) shared notions of validity- that is intersubjective, internally defined criteria for weighing and validating knowledge in the domain of their expertise; and (4) a common policy enterprise – that is a set of common practices associated with a set of problems to which professional competence is directed, presumably out of the conviction that human welfare will be enhances as a consequence'.*

Although the author develops this definition as a political scientist, which is especially visible in (4), the definition is applicable also to communities in business. This definition makes clear that concerted effort and reciprocal interdependence need some value based, shared beliefs. It yields an elaboration of the notion of a social structure or organization as a 'focusing device', indicated before. It indicates different dimensions of mutual identification: values, causal beliefs, notions of validity, and purpose. Shared beliefs relate to: beliefs about the social (inter-)actions which should be taken (in Haas'definition point 1) and shared beliefs about the validation criteria for applied knowledge (in Haas' definition point 2 and 3). The notion of shared beliefs about interaction and about the validation of knowledge is a recurring feature in the definition of epistemic communities. Because of these shared beliefs concerning values, a community is also called a 'moral or normative community'.

Pentland (1995: 7) tries to deepen the argument of shared beliefs about validation criteria and argues that behind such beliefs the same epistemic criteria can be identified: 'Epistemic criteria act as rhetorical resources for members of an epistemic community to debate each others' knowledge claims'. Pentland (1995:6), following Holzner and Marx (1979), defines four types of epistemic criteria:
- ritual/superstituous
- authoritative
- pragmatic
- scientific

An epistemic community has agreed on one or several of these epistemic criteria in the course of interaction. Haas (1992) equals these epistemic criteria with agreement on methodology and as such epistemic criteria might not be sufficient as 'focusing device'.

There is not much literature on the emergence of the shared epistemic criteria. Is it a process of self-selection between the members, where members are attracted to each other on the basis of applying the same epistemic criteria? Social identity theory would confirm this approach. Research on the development of cooperation in a (scientific) network also supports this view (Kreiner and Schultz 1993). As participants carefully approach each other step by step through the exchange of 'gifts', a process of 'getting to know oneself slowly' takes place, which ends in a network with reliable participants who share the same epistemic criteria. In sum, shared criteria can arise by self-selection and mutual identification.

**Foundations of alignment**

Here, to avoid possible confusion, we revert again to the term 'explorative' rather than 'epistemic' community. The question is what the epistemic basis for collaborative exploration is. The special feature in an explorative community is that 'collective structure' embraces a diversity of knowledge, at a cognitive distance that is large enough to allow for exploration and small enough to allow for shared criteria. Shared beliefs for the undertaking of social actions and validation of knowledge are believed to be necessary conditions in order to adjust to each other. However, it is still unclear on what level and in what domain shared beliefs should exist and how these develop. Therefore, we will now turn to a more detailed specification of shared beliefs.

The use of knowledge in explorative communities, as indicated, has several properties:
- there is a distribution of diverse knowledge over the members of the network
- next to this diversity, there also exist shared epistemic criteria for the validation of this knowledge
- the structure of relationships (density, strength) makes that it is perceived as a collective structure

The question arises how these double, paradoxical functions of diversity and sharing in an explorative communities can co-exist. Next to the assumption that people naturally select similar others with the same epistemic criteria, we focus on the more dynamic view of the development of shared epistemic criteria. And in this way, shared epistemic criteria imply more than just consensus on methodological criteria.

We argued that the network structure in an epistemic community should be viewed as a 'collective structure'. The main point here is that not the entities (the participants with their diverse knowledge, or nodes in the collective script) determine the behaviour of the whole structure, but their interrelationships. Through this interrelationship alignment or adjustment between the participants should develop without neglecting cognitive diversity.

The interrelationships result in shared epistemic criteria that are necessary for a shared interpretation and the validation of knowledge. This requires a 'communication code' or 'communication rules'. Schall (1983: 56) defines communication rules as follows:

*'Communication rules have been variously defined but, in general, they are considered to be tacit understandings (generally unwritten and unspoken) about appropriate ways to interact (communicate) with others in given roles and situations, they are choices, not laws (though they constrain choice through normative, practical, or logical force), and they allow interactors to interpret behaviour in similar ways (to share meanings). Communication rules differ from social norms in focusing on prescribed message exchange, interpretation, and interaction sequencing.'*

In order to realize this sharing, a kind of collective memory, some process of storing, has to be assumed. For this, we adopt the concept of 'transactive memory' that, according to our view, unites the notion of collective structure with the notion of communication rules. The concept of transactive memory (Wegner, Giuliano and Hertel 1985; Wenger, Erber and Raymond 1991; Wegner 1995) is defined as follows (Wegner, Giuliano and Hertel 1985:256):

*'(1) an organized store of knowledge that is contained entirely in the individual memory systems of the group members, and (2) a set of knowledge-relevant transactive processes that occur among group members. Stated more colloquially, we envision transactive memory to be a combination of individual minds and communication between them. This definition recognizes explicitly that transactive memory must be understood as a name for the interplay of knowledge, and that this interplay, no matter how complex, is always capable of being analyzed in terms of communicative events, that have individual sources and individual recipients. By this definition, then, the thought processes of transactive memory are completely observable".*

We don't agree that 'thought' processes are observable. What is observable is communicative events, and what people think depends on how they attribute meaning to those events, which depends on their mental frames, which entails greater or lesser cognitive distance. However, sharing a language for communication, they have sufficient absorptive and communicative capacity to cross cognitive distance. The greater cognitive distance is, the greater the scope and flexibility of these capacities must be.

The authors suggest 'a set of communication processes whereby two minds can work as one' (Wegner, Giuliano and Hertel 1985:263). More specifically, they suggest processes of differentiation and integration which deal with various parts of the memory structure. This structure consists of three types of knowledge: 'lower order knowledge' which is the detailed, individualized knowledge and 'location knowledge' which is already shared knowledge. One member has detailed ('lower order') knowledge/expertise, which the other members do not possess and both know at which place which knowledge is localized (location knowledge). It could be said roughly that declarative memory is individualized but procedural memory is collectivised . (Cohen and Bacdayan 1996). In this way, all the members of a group have a shared 'directory' or 'location information'. For instance, members in a group commonly know who is expert on a certain issue. In terms of scripts: they have sufficient knowledge of the group script to know where the nodes are and what they do, without knowing the sub-scripts embedded in any node other than their own, i.e. without knowing how they do it. In other words, the communication code entails shared representations of a collective script.

All this is consistent with the notion of Schein (1985), indicated before, of culture as a 'deep structure' of shared mental frames. Those, then, are part of any communicative code. This may yield problems concerning the use of the term 'code' which may suggest that it is fully codified, or codifiable. To the contrary, such fundamental mental frames tend to be inescapably tacit and uncodifiable. Perhaps, we should use another term than 'communication code', such as 'shared language' or 'system of meanings', perhaps.

Sometimes this is called meta-memory (Wegner 1995) or group memory (organizational memory). This location-knowledge serves the efficiency of knowledge-identification (who knows what) and knowledge retrieval. Experiments by Moreland (1999) seem to affirm these findings. Groups which are jointly trained to learn about the expertise of others seem to perform better.

*Proposition 5: in explorative communities collective structures (scripts) are mentally represented on the basis of a shared communication code, to connect individualized knowledge.*

When an individual member enlarges his/her knowledge, this must be communicated to the other members (see the above mentioned experiment by Moreland 1999). Thus, communication processes for connecting location knowledge must be institutionalised within the community. Orlikowski and Yates (1994: 542) coin the notion of genre and argue:

*'a genre established within a particular community serves as an institutionalised template for social action – an organizing structure – that shapes the ongoing communicative actions of community members through their use of it. Such genre usage, in turn, reinforces that genre as a distinctive and useful organizing structure for the community.' The use of a genre serves a certain purpose and has certain forms – like face-to-face meeting, e-mail, formal presentation. A group has a certain repertoire of genres. The use of a genre indicates the communicative practices within a collective and* structures *social interactions: 'As members engage in communicative practices based on their initial understanding, they produce a structured pattern of social interactions [communication rules] that defines and establishes the genre repertoire of the community. .... The establishment and reinforcement of a genre repertoire reflects the tendency within communities toward institutionalisation and results in the habitual enactment of particular behavioural routines'.*

*Proposition 6: Whatever genres are used in an explorative community – which is a question of earlier experience of the members – they should support the development of shared location knowledge.*

**Epistemic criteria**

Another part of the differentiated structure of a transactive memory is that 'knowledge of general topics is shared by both persons' (Wegner, Giuliano, Hertel 1985:265). This seems one of the most difficult features within a community. For instance, in an organization that is involved in research on alternative energy generation, the distribution of expertise was rather well institutionalised, but when the different experts had to describe their possible contribution to a new technology, they could not say much. They did not dare to specify what contribution their expertise could have to the result nor to the innovation process. This organisation used a certain technique (*Matheson: The smart organization, HBS Press*) in order to create a shared, quantified map about the technological and application uncertainties of the new product for energy generation. The map is similar to mental maps often supported by computer simulation (Vennix 1996).

The shared map helped them enormously in collaboration, in two ways: 1. the sequence and critical path of various contributions became visible to all contributors and 2. commitment increased. What happened here? The group not only obtained an overview of the various sources of expertise, but also a communication code. We believe that the shared map helped them to make the different epistemic criteria that were applied visible, to share them and to discuss them. Epistemic criteria hereby should not only be understood at the level as defined by Pentland (see above). All the engineers applied more or less the same scientific epistemic criteria in the sense of the same methodology. Before a common cognitive map was developed, they did not know from each other how they estimate the chances for success of the whole and they did not know from each other the estimated contributions and expectations for

success from the diverse disciplines. In this sense they did not share the same problem-related epistemic criteria.

This brings us to the conclusion that sharing the same epistemic criteria for validation and delimitation of the diverse expertise is the result of sharing (cognitive) interpretations of a problem-situation. When communicating about interpretations delimitation and validation of knowledge (Lazaric 2002) takes place. The notion of transactive memory makes clear that delimitation and validation cannot take place on the level of the different forms of expertise. This would indeed be impossible as the expertise is distributed and, of course, specialized. Validation must take place on the base of shared interpretations of differences.

Here, we apply a cultural-historical approach to distributed cognition (Lorenz 2002), which has the following underlying assumptions. First, when encountering a problem situation, people do not make an objective representation but an at least partly subjective interpretation. Secondly, interpretations of a problem-situation by various participants are considered a cultural tool. Thirdly, making sense of the various interpretations takes place in on-going interpretative acts. Shared epistemic criteria therefore should be perceived as a result of interaction and negotiation processes on the base of different interpretations. These processes take as 'working material' the existing interpretations of the various team members. 'In summary then, the problem of knowledge in knowledge-intensive firms is not a problem of simply combining, sharing or making data commonly available. …. Making explicit representations of one's knowledge and understandings to exchange with others enables one to better appreciate the distinct ways of knowing that those others will attempt to communicate'(Boland and Tenkasi 1995:359). Shared epistemic criteria are not first shared and then applied– as the definition of an epistemic community may suggest. It goes the other way round.

All this is entirely consistent with our social constructivist theory of knowledge, set out before, which is also called 'situated action theory of knowledge' or 'activity theory'. Frames of knowledge arise from practice, from interaction in specific contexts. That is why it is problematic to use the terminology of 'communities of practice' and 'epistemic communities': epistemic criteria arise from practice.

*Proposition 7: Shared epistemic criteria are the result of negotiation processes for validating knowledge.*

*Proposition 8: The negotiation processes use as their material the diverse interpretations of a problem situation, distributed across the members of a team.*

The cultural-historical (or situated action, or social constructivist) approach has a further implication. Because shared criteria only develop in negotiation processes with interpretations as a working tool, shared epistemic criteria are not visible as such. They become only 'visible' in their emergence in negotiation processes, and in their subsequent application. Cook and Yanow (1993), for example, describe the 'unique, unambiguously recognizable style' of Powell flute makers as 'deeply embedded in the practices of each workshop'. They argue that this style cannot easily be transferred to other workshops.

On a more theoretical level, this perspective is also confirmed by the historical-cultural approach (Lorenz 2002: 23):

*'The historical-cultural approach to cognition implies that the routinized and problem-solving behaviours of organizational members are emergent features of their interaction in carrying out distributed tasks with the help of external and internal mediating devices. By external mediating devices I am thinking not only of tools, equipment and plant layout, but also of verbal texts such as standard operating procedures and instruction manuals that provide some sort of verbal description of the performance of tasks and skills. By internal cognitive artifacts I am referring to the internalized representations of these texts in the minds of the organisation's members'.*

Shared epistemic criteria result from negotiation, but also form shared criteria about negotiation and collaboration. The function of epistemic criteria has changed from validation criteria for knowledge into procedural criteria for collaboration and negotiation. Cowan, David, Foray (2000) argue that these procedural criteria are highly tacit although the knowledge itself (or better: the interpretations) can be highly codified. We suggest that the reverse can also apply: procedural criteria may be partly codified, while the underlying knowledge may be highly tacit. Epistemic criteria therefore are to be perceived as communication rules (Schall 1983). Schall also identifies the double function of communication rules for both developing a shared interpretation of a problem and for structuring the interaction patterns.

Here, we can identify a second type or aspect of communication, which we consider necessary for explorative communities. In the literature, this type of code is equated with the cultural perspective in learning groups (Cook and Yanow 1996). In an analysis of the innovation processes for making a new flute, Weick and Westley (1996: 448) claim that there must exist a common identity: 'In moments of organizational learning, people may want to take on a new situation but not a new identity. Learning may be most likely to occur when situations are explored but identities are exploited'. The authors further explain that learning should be viewed as a moment of reflection and change within 'normal' operations. Cook and Yanow (1993) argue that the flute makers had a common understanding how a Cooper flute feels. Within this common feeling they were able to invent a new flute with another scale but which still was the typical Powell flute. People were related to each other, which has its origin in the common practice. Haas' definition, given before, describes an epistemic community as a network which has 'a shared set of normative and principled beliefs, which provide a value based rationale for the social action of community members'.

*Proposition 9: In an explorative community, shared epistemic criteria take the form of communication rules that connect different interpretations of a problem situation. When these rules are shared and institutionalized, we can speak of a code, <u>but a highly tacit one, perhaps better called a shared 'system of meanings'</u>. This constitutes the core of any community. A community of exploitation goes further, but for a community of exploration it constitutes a minimum requirement.*

**The role of trust**

Trust is far too large a subject for a systematic analysis in this paper, and we summarize only the essentials that are relevant here (for a survey of the trust

literature, see Nooteboom 2002a). To solve the social dilemma, people require trust in each other: in both their competence and their intentions to contribute to shared goals. There are two levels of intentional trust. One refers to the absence of free riding and opportunism. Opportunism entails an active, conscious effort to expropriate advantage from others, by lying cheating, and the like (Williamson 1975). In the absence of opportunism there is need for trust in the commitment and care that people will observe, to avoid mistakes that are harmful to others or the joint cause.

Nooteboom (2002b) makes a distinction between 'reliance' and 'real trust', or trust 'in the strong sense'. Reliance includes control of behaviour by limiting opportunities for opportunism (by contracts or hierarchical supervision), or by giving incentives not to utilize such opportunities, with rewards, mutual dependence, or a reputation mechanism. Trust in the strong sense is defined as the expectation that others will not cause harm even if they have both the opportunity and the material incentive to do so. That may be based on ethics, routinized behaviour, or personal bonding on the basis of identification (the sharing of perceptions, values, goals). The latter takes time to develop, on the basis of prolonged, shared experience, in mutual dependence (McAllister 1995, Lewicki and Bunker 1996).

Identification based trust is an important enabling feature of communities of practice or exploitation. The problem of such communities is, however, that identification tends to yield too little cognitive distance and variety for exploration.

The problem for explorative communities, on the other hand, is how to open up to more diverse, flexible, and less durable contacts and yet establish trust. If shared perceptions and values are not in place, and are not given the time and stability to develop, governance of relational risk lies more in control and extrinsic motivation, which has its problems. The paradox arises that especially in exploration, uncertainty is high, as well as the need for flexibility to enable scope for unpredictable activities and novel combinations, so that the basis for control is limited. Contracts cannot be complete due to uncertainty, and may be undesirable in limiting flexibility and scope of actions. The monitoring needed for control can be difficult, due to tacitness of knowledge, lack of openness to protect interests, unfamiliarity with novelty, and difficulty to judge performance. This is difficult even if the relevant information were available, because one may not have the absorptive capacity to interpret it. In other words: communities of exploitation have a problem in exploration, and communities of exploration have a problem in the governance of relational risk.

**Learning and embeddedness**

To realize learning, a system of shared meanings is not sufficient. It constitutes a minimum but not a sufficient condition. On the basis of it, there people must contribute, combine, confront variety of expertise, and developing something new. Wegner et al. (1991) argue that the presence of only location-knowledge at the group level and detailed expertise at the individual level would hollow out interaction in a short period of time. There would be no more than distribution of cognitive labour. Therefore, next to differentiation processes, integration processes are needed. 'They [people in communities] commonly try to find higher-order topics that are shared, and then trade their lower-order information on these topics, often at length. The remarkable feature of such sharing is that it frequently leads to new knowledge for both partners'(Wegner, Giuliano and Hertel 1985: 267). Shared higher-order knowledge is developed occasionally as the group encounters common themes,

problems or issues. At that point, the different interpretations meet each other and are negotiated. However, commitment to a common problem is a condition.

The question then remains, what makes members of an epistemic community commit themselves to a shared problem? Or – in the words of Wegner et al. – what makes people to commit to a shared higher order topic. Why are members of a group or community inclined to cooperate in a common problem and to negotiate meanings? Part of the answer lies in the classical definition of a group given by Deutsch (1973): because they cannot realize a goal alone. Mutual dependence is required. The concept of transactive memory strengthens this argument. People have diverse knowledge and they need the individual's local knowledge in order to innovate. But it is not clear how participants in an epistemic community commit themselves to a common problem.

This brings us back to the issue of governance: motivation and the control of relational risk. In that context, we discussed the role of trust. The subject of governance is too large to cover in this paper (see Nooteboom 1999). Here, we only want to connect that issue to the earlier discussion of the structure of networks. Opportunities for governance and forms of governance are related, among other things, to structural embeddedness (Granovetter 1992: 33): '"Embeddedness" refers to the fact that economic action and outcomes, like all social action and outcomes, are affected by actors' dyadic (pairwise) relations *and* by the structure of the overall network of relations'. Both forms of embeddedness mould the behaviour of the individual, but in different ways. The first aspect of embeddedness is called relational embeddedness and is often operationalized as the type of ties (strong/weak) between dyads. The second aspect is structural embeddedness, which indicates that behaviour of an entity in a network is influenced by the structure of the surrounding network. It allows for 'more efficient information spread about what members of the pair are doing, and thus better ability to shape that behavior' (Granovetter 1992:35). Note that only relational embeddedness is related to weak-strong ties and structural embeddedness is related to density, centrality and structural holes in networks.

It is generally assumed that dense networks are appropriate for exploitative learning, as information is limited but fine-grained *(*Uzzi 1997*)*. Sparse networks with many structural holes are perceived more appropriate for explorative learning (Rowley, Behrens and Krackhardt 2000*)*. However, research by Rowley et al.(2000) did not confirm this.

We have to be careful here, in distinguishing between opportunities for learning that arise from diversity and flexibility, and issues of governance. Structural holes, i.e. lack of connections, indicate unutilized opportunities for novel combinations. Density has implications for governance.

Some authors argue that the development of a governance structure is easier in a dense network with high structural embeddedness, because in this way individual behaviour can be controlled through effects of reputation and surveillance (Jones Hesterly, Borgatti 1997; Coleman 1988). 'While interconnectedness involves norm creation at the network level, relational embeddedness creates trust at the dyadic level' (Rowley, Behrens and Krackhardt 2000: 372). That is certainly true. At the network level, density has implications for the formation of coalitions to constrain opportunistic members, and for reputation mechanisms. Interconnectedness or structural embeddedness furthers the expectations that the system will function as a whole, in system-trust. At the dyadic level, strong ties may entail identification-based trust that stabilizes the dyad (Nooteboom 2002b).

To properly deal with governance, insights from network theory must be combined with other concepts and instruments of governance, which may partly be derived from transaction cost theory. That synthesis goes beyond the scope of the present paper (see Nooteboom 1999, 2002b).


## CONCLUSION

Communities are considered an important intermediate level in organizational learning. Here, common knowledge can be constructed which can be used for organization-wide learning.

Epistemic communities are characterized by the use of diversity of knowledge. Epistemic communities can also be circumscribed as communities of exploration in order to stress innovation and exploration and not to fall into the trap of learning on the basis of practice (or non-canonical knowledge) versus learning on the basis of declarative knowledge. The main question that is tried to answer in this paper is how cooperation can take place under the condition of cognitive distance within a community. Per definition cooperation must take place on a higher level than the individualized knowledge base as the individuals differ in their knowledge. Three conditions are identified: 1. A community should be viewed as a collective structure and not as a (centralized) network. 2. The concept of transactive memory adds to this that such a collective structure is characterized by a shared communication rule that links the individualized knowledge. This communication rule must be maintained. 3. The communciation rules within a collective structure should be considered as highly tacit codes that regulate the negotiation processes. In this way, shared epistemic criteria should not be viewed as consensual methodological criteria but as procedural criteria. We suggest the development of shared epistemic criteria as the most important means in order to bridge cognitive distance. By this, epistemic criteria are the shared interpretation of differences.

Governance of an epistemic community is related to embeddedness into a network. However, it is still unclear how exactly the development of a collective structure is furthered.

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