Reinforcing Shared Context to Improve Collaboration

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ABSTRACT: Contributing with and using knowledge is a communication process among the organization’s actors. As a communication process, the transfer of knowledge among actors can only be effective if there is a common interpretive focus and context where they can understand each other and communicate. The concept of context plays an important role in collaboration, specially on what is concerned to facilitate communication, interaction and knowledge sharing, reflecting on group work productivity, quality and satisfaction. What we expect to do in this work is to explore the formalization of context in order to understand how context is shared in a group. We address the representation and dynamics of context discussing its implications and opportunities to improving collaborative work support.

KEY WORDS: context management, collaboration support, knowledge management, collaborative learning.

RÉSUMÉ: La contribution à la connaissance et l'utilisation des connaissances correspond à un processus de communication parmi les acteurs au sein d'une organisation. En tant que processus de communication, le transfert de connaissances entre les acteurs ne devient effectif que s'il y a un focus interprétatif commun aux acteurs et un contexte dans lequel ils peuvent communiquer et se comprendre entre-eux. Le contexte joue un rôle important dans la collaboration, spécialement sur ce qui peut faciliter la communication, les interactions entre-eux, le partage des connaissances, la réflexion sur la productivité du groupe, la qualité et la satisfaction. L'objectif du travail présenté ici est d'explorer quelle formalisation du contexte nous est nécessaire pour rendre compte de la manière dont le contexte peut être partagé dans un groupe. Pour cela, nous considérons explicitement l'hétérogénéité et la dynamique du contexte, ce qui nous conduit à discuter des implications et opportunités pour améliorer une aide au travail collaboratif.

KEY WORDS: Gestion du contexte, aide à la collaboration, gestion des connaissances
1. Introduction

Collaboration is in such a way intrinsic to nowadays business processes, that improving collaboration implies in improving the processes where it occurs. Especially concerning knowledge intensive working processes, collaboration is essential. The main reason it that most part of the organization’s knowledge relies in people’s minds, previous experiences and background and offers many challenges to be represented and stored.

We have seen many efforts on organizing, storing, and reusing organizations’ available knowledge, as an attempt to make true and effective the concept of organizational memories (OM) (Ackerman, 1994) (Abecker et al., 1998). However, creating an effective collaborative work environment requires more than just codifying knowledge, storing it in information systems and developing access and distribution. It is also a matter of facilitating contact, communication, mutual understanding and sharing. Contributing with and using knowledge is a communication process among the organization’s actors. As a communication process, the transfer of knowledge among actors can only be effective if there is a common interpretive focus and context where they can understand each other and communicate.

Our research is based on the assumption that a professional can not use the knowledge that exists in the organization if he is not able to understand the context, the environment, and the conditions that surrounded that knowledge when it was produced and when it must be used. On reverse, one cannot contribute with knowledge if its context is not conveniently explained. Additionally, while performing a specific task at hand, as inserted in such a complex, social and collaborative work, any professional should be aware of the overall moment, situation, group and environment – the context – where his activity is inserted in order to effectively communicate, share knowledge and collaborate.

Context plays an important role in collaboration, specially on what is concerned to facilitate communication, interaction and knowledge sharing, reflecting on group work productivity, quality and satisfaction. What we expect to do in this work, indeed, is to explore the formalization of context in order to deeply understand how context is shared in a group. Our hypothesis is that the understanding of this dynamics allows its applications in different domains where collaboration, knowledge sharing and organizational learning is necessary.

In this article we address the representation and dynamics of context based on previous characterization of this concept (Brézillon, 1999), discussing its implications and opportunities to improving collaborative work support. To start this discussion we present, in Section 2, the concept of context, what can be the different dimensions of context for a given situation and how knowledge is dynamically
mobilized along these dimensions in any problem-solving or reasoning situation. We also discuss the relation among context dynamics to individual knowledge management and learning. In Section 3 we examine how the context dimensions and the knowledge movement among them takes place in a collaborative interaction. We describe how context is built and shared using a short software development scenario as an example. In Section 4, we make considerations on the relevance of turning context and its dynamics explicit in a collaborative interaction and what are the implications of doing this to improve collaboration, to improve knowledge sharing and to collaborative learning. Section 5 concludes the article, motivating us to the possibilities of integrating context into collaborative support applications.

2. Context

Over the last years, the interest on context and its implications on many areas have brought to light a research community on this theme. In any domain where understanding, reasoning, problem-solving and learning are needed, the concept of context plays an important role. In general terms, context is a complex description of the knowledge shared on physical, social, historical and other circumstances where actions or events happen in the real world. All this knowledge is not a part of the actions to execute or the events that occur, but will constrain the execution of an action or event interpretation without intervening in it explicitly (Brézillon, 1999).

To work with context, it is necessary to have a sound characterization of what this concept is and how it works in our cognitive, social and work activities. Based on previous conceptualization (Brézillon, 1999) of context, this section discusses what are the different types or dimensions by which context can be characterized and how context is used, managed and changed through these dimensions during the process of individual reasoning.

2.1. Context and focus

Ten years ago, people interesting in the notion of context in Artificial Intelligence were divided by following one of the two viewpoints, namely the Engineering viewpoint and the Cognitive Science viewpoint. According to the Engineering viewpoint, context had a discrete and static nature, while Cognitive scientists saw a unique context evolving continuously.

Now it is known that these opposite positions existed because it was not taken into account that context is always relative to something, an object, an idea, reasoning, a behavior, etc. Thus, the context of an object can be described in a static way, while the context of reasoning evolves when the reasoning is developed and goes from one step to the following one. We will sum up this point by saying that a
context is relative to a **focus of attention**. Based on the lessons learned, it is clear that it is not enough to say that. Indeed, the focus and its context are intertwined.

The focus determines what must be in its context. For example, a focus on software development supposes that information on the programming language, the constitution of the designer team, etc. is contextual information, i.e., information that could eventually be used when the focus evolves. Conversely, information on the designers’ personal life may not concern the focus and thus is not in the context.

The context, in turn, constrains the focus. For example, the way in which a method is selected at a given step of a problem solving. A software programmer will focus his programming activity in defining classes and methods when in an object-oriented project while he/she will define modules and functions if the project uses the functional paradigm. Indeed, some contextual elements are considered explicitly, say for the selection of the method and thus can be considered as a part of the way in which the problem is solved at the considered step.

### 2.2. A horizontal view on focus and context

Each person uses a large amount of knowledge, different from one person to another, to picture a situation. We can define as **contextual knowledge (CK)** all the knowledge that is relevant and can be mobilized to understand a given situated problem. By "situated" we mean in given, dated, well specified circumstances. The word "situated" was introduced into artificial intelligence by Clancey (Clancey 1991a and Clancey, 1991b).

Contextual knowledge is personal to a participant and it has no clear limits (MacCarthy, 1993). It is evoked by situations and events, and loosely tied to a task or a goal. However, when the task becomes more precise, a large part of this contextual knowledge can be proceduralized according to the person’s current focus. Although the contextual knowledge exists in theory, it is actually implicit and latent, and is not usable unless a goal (or an intention) emerges. The contextual knowledge is dependent on the situation (date, location, participants), it is a sub-part of the overall context. Thus, the rest of the context, which is not relevant for a given situation, is called **external knowledge (EK)**.

When an event occurs, the attention of the actor is focused and part of the contextual knowledge will be proceduralized. The **proceduralized context (PC)** is a part of the contextual knowledge that is invoked, structured and situated according to a given focus. Figure 1 illustrates the three horizontal dimensions of context.

A main difference between the contextual knowledge and the proceduralized context relies not on the pieces of knowledge used themselves, but mainly in the structuration (ties) of the pieces of knowledge in the PC, structuration that does not
play a predominant role in the contextual knowledge because the PC building is focus-driven, not the contextual knowledge.

![Diagram of contextual knowledge](image)

**Figure 1. Horizontal view of context**

Another important difference between contextual knowledge and a proceduralized context is that the pieces of contextual knowledge in the PC, beyond the fact that they are assembled and structured, they are also instantiated. Each contextual element of the PC is considered through an instantiation. In that sense, the proceduralized context appears as a contextualization of the contextual knowledge according to the focus and the practice developed for the focus.

### 2.3. A vertical view on focus and context

It is also possible to organize context in different levels, from the more general to the more specific, since contexts are different by their granularity (Brézillon, 2003). For example, an enterprise’s context is more general than its employees’ context. This has important consequences on the context that is intertwined with the focus. Different contexts must be distinguished to be managed differently. For example, there are the contexts of the work group, of each member individually, the project, the firm in which is the work team, the market in which the firm has to fight, etc.

Indeed, a focus at the level of an individual is related to the individual context, but also to the group context in which is the individual and the organization context in which is the group.

All these contexts are not at the same level of generality. For example, the context of group contains more general contextual information than the context of each individual. This also does not imply that a context at one level is a subpart of a more general context. For example, a designer’s context can contain contextual information coming from his experience working in another firm.

Figure 2 illustrates this idea in the case of a software development organization. At a given focus or situation that takes place inside the organization, its context can be understood at different levels. While programming a software module, the
context of a programmer can be explained in terms of the language he is using, the module specifications, the status of the programming task etc. From the perspective of the team, the context determines that this programmer is building the module that will have to be integrated to the code being constructed by other programmers. From the perspective of the organization, it is being observed that one of its employees is getting even more skilled on a specific programming language and system.

![Diagram](image)

**Figure 2. Vertical view of context – the example of a software development organization**

Issues concerning the circulation of the data, the information and the knowledge among the different contexts also arise. This supposes some mechanisms of translation between contexts at different levels of the context hierarchy. For example, for a designer, contextual information attached to the firm is at a too general level for him to be applied directly. For example, “Use a non expensive tool” could be contextual information in the firm context. This contextual information needs to be translated (or instantiated) in a concrete way by the designer (e.g., as a rule “select a piece of software in open source” into his proceduralized context).

2.4. The dynamics of context – how the PC is built

Reasoning is a dynamic process. Being dynamic, it is reasonable to say that it indicates a movement along the different dimensions of context explained above. This movement determines that the content of the context evolves continuously all through the reasoning process. Mainly, in terms of the view on context as external and contextual knowledge as well as proceduralized context, we said that a proceduralized context is built from a sub set of contextual knowledge that is collected, organized, assembled and structured according to the current focus. At a given focus, one person selects a subset of contextual knowledge and assembles the
elements or pieces of knowledge available in this subset in order to align the PC with the focus.

We will illustrate this idea through a brief example. Imagine a business analyst – James – that has just been contracted to work on a software development company – Sw&Sw. He received an e-mail from the senior manager asking him to treat a new maintenance request made by one of their clients – Telcoo.

While reading the e-mail – the current task and focus at hand – James used part of his contextual knowledge to notice that it was something important and that he should take care of it quickly. He knew that because the message was sent by his superior and, as he wished to make a good career in Sw&Sw, this kind of behavior was important. However, James had received many requests from the senior manager on that week and though, he thought that it would be better to take care of the other requests before thinking about the new one.

James’s knowledge is much wider than the portion he effectively used in this current focus. However, what was really needed in the case of this specific task, in order to determine the message relevance is more restricted, corresponding to the necessary contextual knowledge at that specific situation. We can visualize James’ context as depicted in Figure 3.

![Figure 3. Schematic view of James’s context](image)

The proceduralized context may also evolve to integrate some knowledge that, up to this moment, has neither been proceduralized nor is contextual (i.e., external knowledge). For instance, let’s consider that, as a novice professional at Sw&Sw, James was not aware of the importance or relevance of Telcoo as one of the Sw&Sw’s clients (this information was not part of the James’s contextual knowledge at the current focus). In order to determine the priority of the request he was receiving at that moment, he should look for information about the client’s importance. The necessary information lied elsewhere in his external knowledge and should be retrieved in order to help him give the right priority to his task.
For one person, the external knowledge may come from his environment or from other persons. By consulting the organization documents, files, archives or intranet, or even asking another colleague, James could find enough information instructing him that Telcoo is an important client and, so, the request should have more priority among others. Figure 4 illustrates this dynamic.

Figure 4. Retrieving information from the external knowledge

Once the current step of the focus is completed (a proceduralized context has been built successfully for the focus), the focus moves towards the next step. At this moment, the proceduralized context is integrated in the body of contextual knowledge of the person. Additionally, a piece of contextual knowledge can become external knowledge (becomes not relevant to the current focus).

For instance, after determining the request priority, James has to prepare an answer to it. In this new focus, the information about the need for treating quickly the request (previously in his proceduralized context) becomes part of his contextual knowledge, constraining his current proceduralized context. Assumptions about his career and information about other requests (previously part of his contextual knowledge) were transported to his external knowledge, since they are not anymore strongly related to it. Figure 5 tries to illustrate it.

Figure 5. Knowledge movement through context dimensions
2.5. Context and knowledge management

Researchers in computer science, mainly in artificial intelligence (AI), generally try to define knowledge by a progressive process of construction starting from data, the semantic structuring of data as information, and the passage from information to knowledge. This appropriation process relies on prior knowledge and is made consistent with the values and beliefs of a subject. It follows that knowledge is both a means and a result of this complex process (Zack, 1999). Figure 6 summarizes this viewpoint.

![Figure 6. Knowledge creation process](image)

The amount of knowledge gathered by an actor influences his data interpretation and information reasoning, delivering new knowledge. Therefore, the existing knowledge constrains the interpretation and appropriation activities of an actor.

It is sometimes argued that context is used both to transform data into information (Wilson, 1984; Zack, 1999) or/and to acquire knowledge (Anderson, 1995; Brézillon et al., 1996). Context is a way of giving knowledge focus and meaning, and the most focused and understandable the context is, the most effective it can be captured and used in a given situation (Figure 6).

When facing a given problem, situation, task or focus, an actor has to interpret and reason over the available data and information. In order to do this, he uses his previous knowledge but not all of it, just the knowledge that is strongly related to the necessary interpretation and reasoning (contextual knowledge). To interpret data, to reason and to appropriate information during a specific focus means to proceduralize it, creating new knowledge that will take part of the actor’s contextual knowledge.

2.6. Context and learning

Learning is a social process that involves building connections: connections among what is being learned and what is important to the learner, connections among what is being learned and those situations in which it is applied, and connections among the learner and other learners with similar goals (Barab et al., 1999; Barab et al., 2001a; Barab et al., 2001b).
The learning process addresses the matter of contextualized knowledge (knowledge and its context of use). When building the proceduralized context at a given focus, any person will have to mobilize, retrieve, assemble and structure its available knowledge (both contextual as external) in order to take decisions or perform his work. The new relations and links created during the PC building is, as a matter of fact, individual learning (focus-oriented learning).

If the addition of a piece of external knowledge in the PC correspond to a kind of knowledge acquisition, it is nevertheless a learning process because the piece of external knowledge is not simply added to the PC, but assembled and connected to the already existing construction.

The proceduralized context is not lost and invariably goes into the contextual knowledge of the person. When the PC goes back in the body of contextual knowledge, this is not only the product that is stored, but also all the way in which this PC has been built, the reasons behind the choices, the alternatives abandoned, etc. In this type of learning, the PC is totally integrated in the body of contextual knowledge. By this way, the more the user works, the more his contextual knowledge becomes structured. The proceduralized context that is stored could be recalled later either as a whole (as a part of a new proceduralized context) or the way in which it has been built will be reused for the new proceduralized context. This is a type of learning by structuration of the contextual knowledge.

3. The dynamics of context in group interaction

In this section we demonstrate how a shared context is built, using the scenario of a collaborative software development activity. Software development is a highly collaborative, social and knowledge-intensive work process and provides us with many possibilities for discussing the application of context. Previous work on the discussion about the application of context in software development can be found in (Araujo et al., 2004a; Araujo et al., 2004b).

3.1 Group focus and context

One of the main characteristics of a collaborative work is the fact that all the members of the team should have the same focus that depends on the team goal. Having the same focus does not mean necessarily having an identical view. Generally, members of a work team come from different areas. For example, in software development, some designers are in charge of the algorithmic part of the software, when others are more concerned by graphical aspects, or simulation. Project managers and the future software users, in turn, will also have different perspectives among them and among programmers, while having the same focus: to
deliver a software product. Thus, the main point here is that all the members of the work team have compatible views on the product to design (Karsenty et al., 1995).

According to Daft and Lengel (Daft and Lengel, 1986) the total understanding of an activity in a group relies on the ways it is possible to reduce the degree of equivocality and uncertainty among members. While uncertainty refers to the absence of information, equivocality refers to ambiguity, that means, the existence of conflicting interpretations about the subjects that the groups deal with during the interaction. Supporting, maintaining and improving the productivity of a workgroup mean to continuously reduce the degrees of uncertainty and equivocality, helping participants to converge their viewpoints. That is the same as saying that the group must keep their collective focus. And to keep it, they must share their contexts.

Two persons having the same focus will build two different PCs. First, because they have two different bodies of contextual knowledge. Second because they also have different interpretations of the focus according to their different body of contextual knowledge. Turning again to our previous scenario, where James – a system analyst at Sw&Sw – received an e-mail message from his superior, asking him to treat a new maintenance request. His proceduralized context, while reading the message, was built as depicted in Figure 7-a.

Imagine that the same e-mail was sent to a Sw&Sw’s senior system analyst – Robert. The manager who sent the message was not Robert’s superior, since Robert is now working on a different division of Sw&Sw. However, the manager sent the message to him because he knew that Robert has been one of the leaders of Telcoo’s billing system development and he wanted Robert’s consulting in this case. Robert, in turn, realized that the message was sent to him due to his previous experience but, as he is not working on the system anymore, he concluded that the message was just a notification to him and decided to wait another contact instead of taking any action. His proceduralized context could be built as depicted on Figure 7-b.

![Figure 7. Different persons with different contexts for the same focus](image)

### 3.2 Collaborative PC building
Figure 8 represents how the proceduralized context is built from contextual knowledge during an interaction between two actors. The interaction context contains proceduralized context pieces in the focus of attention of the two actors. These pieces of knowledge are extracted from the contextual knowledge of each actor; they are organized and structured jointly by both actors and result in a shared knowledge. The proceduralized context shared by the interaction participants contains those portions of knowledge explicitly made available by each member. Other aspects of the private contextual knowledge of each participant will remain private unless its owner decides to turn it explicit.

![Figure 8. A representation of the shared context](image)

As described in section 2.4, as a novice professional at the organization, James needed to search the organization (his external knowledge) in order to find information about Telcoo and to determine the priority of this request. In a collaborative interaction, most part of the external knowledge of each participant comes from the other persons in the work group. In the scenario, from his proceduralized context, James noticed that he needed additional information in order to deal with this task. He should be aware of the request details: what was being requested and why. However, he did not know who the client’s contact was and who would be working with him on that. Additionally, and most important, he should contact the senior management to know his vision and perspective on this request.

Reading the message again, he noticed that it was sent to two other business analysts: Robert and Lucy. He knew Lucy from other development project where they worked together (social information that stayed tacit on James and Lucy’s knowledge. It was a proceduralized context at that time and became a chunk of contextual knowledge after). Due to this proximity, he called her on the phone. Lucy told him that she had not read the mail yet and that she did not also know too much about the request. She agreed with him that is was an important request but she was in charge with another system deployment and she did not know if she could work on the new request by that moment. She suggested scheduling a meeting with the senior manager on the next day – her agenda was still free in the morning.

At this moment, James and Lucy constructed both an extended shared context with new proceduralized contexts by sharing information about their view about the Telcoo’s request, their availability to participate on it and that they still needed more
information. If this knowledge chunk belongs to the common part of the contextual knowledge of the two agents, the pieces are integrated into a mutually acceptable knowledge structure, and the knowledge structure may then be moved to the shared part of the contextual knowledge of each agent. Thus, the proceduralized context contains all the pieces of knowledge that have been discussed and accepted (at least made compatible as quoted in Karsenty et al. 1995) by all the agents. These pieces of proceduralized context then become part of the shared contextual knowledge of each agent, even if they do not remain within the focus of the proceduralized context, as shown in Figure 9.

![Diagram](image)

**Figure 9. Shared context between James and Lucy**

James did not know Robert before and decided to be more formal, sending him a message. Some minutes later, he received a phone call from Robert. He was inviting James for having lunch together and so they could talk about the Telcoo’s billing system. As he was one of the business analysts who worked on the project and he could have an idea of what they would be asking for. James scheduled a meeting with the senior management secretary for the next day.

After lunch, James called Lucy to confirm the meeting with the senior management and to tell all the information he obtained from Robert: when the project finished, many system requirements have not been included on the final version due to the required deadline for turning it operational. Users still lack a list of information reports that were not included in the current version. Robert told him that the billing system users could not reach a consensus on what should be the reports to be included in the system. This made them to include just the basic ones.

At this moment, the team has assumed a context for the task to be performed. Although not yet confirmed, they were trying to make sense by their own and contextualize themselves on what they were supposed to do. Now, Lucy, Robert and James have almost the same contextual knowledge about the task: they know this
maintenance task is highly important for the organization, they now know each other and a little bit of their previous experiences in respect to the task: they are aware of each other’s availability and of what need to be done next: to talk with the senior management (Figure 10).

It can be also remarked from Figure 10 that just a portion of the contextual knowledge of each participant becomes public, assembled and shared through the resulting collective proceduralized context. Other personal aspects and knowledge remained private into each participant’s contextual knowledge.

![Figure 10. Shared context between James, Lucy and Robert](image)

In the meeting, the senior management explained what the Telcoo’s request was, confirming the team expectations. Users needed new reports in order to perform data analysis and to help senior executives’ decision-making. Therefore, this request has been made directly from senior executives and not from the system users and managers. This fact made the system maintenance highly political and most of all, even more strategic and risky for Sw&Sw. Pressure was the new information introduced into the group proceduralized context.

A new task was also shared: the elaboration of a complete plan for the end of the week. Notice that while the group focus now turns to be the meeting, the shared context of the previous activity – treating the request - remains now as a contextual knowledge of the task itself. James, Robert and Lucy discussed about how they could get organized in order to build the plan. The task context needed to be proceduralized again into a more specific focus; building the maintenance plan.

The task of meeting together has turned into each participant’s contextual knowledge by now. The knowledge gathered so far by each participant is turned implicit to the following tasks they will have to perform. For example, knowing that
they need to take care of Telcoo’s request and that it is a relevant task for the organization is now part of each participant’s contextual knowledge and just don’t need to be said or remembered every time again. They have already shared and integrated this knowledge into the shared context and into their individual contexts.

4. The implications of being aware of the shared context

Analyzing the scenario, we can point out some observations. It becomes clear that at each task or focus, a group of actors take part of it, contributing to the task with an amount of their contextual knowledge for developing the contextual knowledge of the task. The contextual knowledge of each actor acts as a filter that defines what pieces of knowledge must be taken into account.

Additionally, the proceduralized context at a given step of a task (i.e., its rationale) can only be explained by the resulting proceduralized and shared context. To understand the overall rationale of a given moment in a collaborative interaction, it is necessary to understand the shared context evolution that took place till that specific moment in time.

The effective understanding of the collaborative situation in order to allow participants to efficiently work is proportional to the possibilities of being aware of each actor’s context and of the overall group context as well. For improving the communication and coordination aspects of collaboration, participants must know their resulting shared context.

However, in most of the situations, we can observe that the shared context among actors remain unregistered. They remain implicit in each participant’s contextual knowledge. The problem that exists in collaborative interactions, managing knowledge or learning collaboratively is that, in many situations, it can be difficult to explain, to communicate and, consequently, to understand the underlying context.

Taking for instance, the situation where a new participant comes into play in any point of the interaction described in the section above. All or part of the shared context so far needs to be somehow explained in order to make this new participant aware of what is expected from him to be done next. In real situations, someone will be in charge of explaining this new participant the overall context of the task at hand. However, this explanation will be marked with his interpretation of the situation at hand and may lack important issues. Also, the person may not be able to articulate all what he knows about the interaction in order to explain it to others.

This leads us to discuss how context can be explicitly managed in collaborative interactions. In the following sections, we consider the benefits of making the shared context explicit, in terms of its implications to collaboration, organizational knowledge management and organizational learning.
4.1 Implications to collaboration improvement

One of the first influenced aspects of making context explicit is group communication. As stated by Winograd (Winograd, 2001), context emerges from the dialog among agents and the interpretation of each agent intention depends on mutually available context. So, the communication process both influences as is influenced by the underlying context.

Effective communication leads, then, to an improved understanding of the problems, needs, goals, expectations, beliefs etc of each participant, of the overall group, and finally, of the task at hand. A shared context allows a simultaneous view of global and local information to make coherent the information and the corresponding action to make. Users who share a context are more likely to interpret data in sufficiently similar ways to be useful than those from widely divergent contexts (Grimshaw et al., 1997).

The more group is able to understand a given situation, the more effective it can be in coordinating their tasks and constructing the expected product or result. Thinking that the contextual knowledge acts as a filter that defines, at a given time, what knowledge pieces must be taken into account from those that are not necessary or already shared, group actors are provided with a sharper and more effective set of knowledge at each moment, turning out to increase their productivity.

Developing a strong shared context is also to reinforce the ties among the members of the work team. The more we go back-and-forth in a conversation, the more we know about each other and can tune our questions and comments to be more aligned with each others interests and needs (Kimball et al., 2000). Most people find that it’s easier to be open and share ideas with people after having establishing previous conversations, informally or not (Kimball et al., 2000). Developing ties through sharing contexts is also a way to reinforce trust among members.

A group context must be developed as a shared context for maintaining its cohesiveness. One of the most difficult challenges for people in a distributed organization is maintaining an image of itself as a whole. This is critical so that the team becomes more than just a loose collection of related parts. Working as a whole is what makes a team powerful (Kimball et al., 2000). The shared social space provides a sense of the whole that enables members of a widely distributed group to see themselves in context. Shared social space actually creates the identity of the group (Kimball et al., 2000).

Finally, turning context explicit and helping group members to visualize the ties, cohesiveness and interaction outcomes, can help workers to feel committed with the work, to better discover possibilities for improving this work, and to be stimulated to work collaboratively (Araujo et al., 2001).
4.2 Implications to knowledge management

From what has been presented till now, we can state that knowledge management is a constant move of retrieving contextual knowledge from different sources and levels; proceduralizing it at a certain focus where it can be combined, and the new combined knowledge can be re-contextualized into other many different levels. Considering group interactions, the relationships between context management and group memories come to light.

Group memory (Conklin, 1996) is a concept used in the collaborative applications research community to represent how groups should organize different kinds of information related to the activities being performed. The group memory must be a place where group members share not only documents and products but also ideas, thoughts and discussions about the interaction. It is argued that it is necessary to preserve the network of information that includes facts, restrictions, decisions and their reasons, the meaning of concepts, as well as the formal documents, in order to completely understand the interaction rationale. Context can be a useful concept to establish ways for managing the information stored in the group memory and to allow the coherent navigation through it, at each specific task or focus.

In a broader view, thinking about a whole organization, and not only a group in specific, the same idea can be applied to Organizational Memories (OMs) (Ackerman, 1994; Abecker et al., 1998). Approaches to assemble context-aware OMs have already started to be conducted (Klemke, 2000). The idea is to explicitly formalize context dimensions along with the knowledge stored in the OM and to provide services for capturing and retrieving context information from it.

4.3. Implications to collaborative learning

Considering again what we discussed in section 2.6 about individual learning through context, we can make a parallel with group learning. So, we can again state that when building the collective proceduralized context at a given focus, the group – through each participant – will have to mobilize, retrieve, assemble and structure each one’s knowledge in order to perform their work.

In any collaborative situation, what is contextual knowledge for a person can be an external knowledge for others. Thus, the learning process happens in two ways. First, if a person wants to introduce a piece of his contextual knowledge in the interaction context, he must decompose and point out all the links (seen by him) with pieces of contextual knowledge existing in the interaction context (and thus already shared for various reasons). Think of a specialist that provides a piece of contextual knowledge from his domain. He is obliged to “instantiate” it to put it in the interaction context in order to make the piece of knowledge acceptable by others.
While trying to make these connections with others’ contextual knowledge he is actually learning or reinforcing what he has already learned before.

Second, the other participants receive the knowledge being contributed, and they have also to establish adequate connections with their own contextual knowledge. This means that the new pieces of knowledge may not correspond directly to the domain of expertise of the person, and the person must make an effort to “translate” this external knowledge to integrate it in his body of contextual knowledge. Additionally, while establishing these connections, he can eventually recognize the need of retrieving new information from his contextual knowledge, contributing and amplifying the knowledge of the group.

5. Conclusion

This work aimed at discussing the relevance of reinforcing context sharing to improve collaboration. It was argued why making context explicit is relevant for the improvement of collaborative interactions efficiency in terms of productivity and quality. However, other social dimensions of collaborative interactions can also be improved such as mutual understanding, trust, ties, commitment and learning.

The investigation on how context can be explicitly shared and collaboratively managed is wide open. Studies on how context information can be modeled and managed in collaborative applications have already started to be carried out. These studies comprise discussions on the relation between context and group awareness, and focus on how a groupware designer can provide a tool with awareness mechanisms for displaying contextual information (Brézillon et al., 2004a, 2004b; Rosa et al., 2003).

This research work is in accordance with other researchers that state the strong relationship that exists between the concept of context and the concept of awareness in group interactions. Our contribution to this discussion is to enlarge the spectrum of possibilities for exploring this relationship through new perspectives. The first perspective, that has been mainly discussed by groupware researchers, proposes solutions for how it is possible to provide to group members awareness of their shared context. A second perspective is, conversely, to analyse how an application, by capturing and being aware of the group context can adapt itself by making available and/or filter the awareness mechanisms and information being provided to interaction participants. A third perspective is to imagine the possibility of having collaborative applications that, based on the group context, could influence the interaction by providing suggestions, clues and orientations to better conduct the work.

However, the development of any of these possibilities starts with the need for defining consistent context models. That is still the great challenge of the research area in context today - to determine what contextual information is for each specific
domain or situation. That is why the current step of the research work here presented is the discussion of what could be the context dimensions for a specific domain – software development - and how they can be managed in software organizational memories

6. Acknowledgments

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7. References


