Role of Context in Social Networks

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Abstract

We propose to apply a context-based approach used in AI for discussing of social networks and virtual communities in the enterprise area. We point out that making context explicit it is possible to provide a global picture of the main aspects of social networks. A first result of this study is that the explicit consideration of contexts—especially shared contexts—could improve notably the collaborative-work processes in an enterprise. A second result is the interest of simultaneously considering the paradigms of context and social network when ICT is at the core of the enterprise. A third result is to point out that different types of context account for the flux of information between groups as well as inside each group. Finally, a parallel is lead between the couple proceduralized context versus contextual knowledge in AI and virtual community versus social networks. This parallel allows to assimilate a virtual community to a contextualization of a social network, i.e. a kind of "chunk of actors".

Introduction

Facing rapid changes resulting from information and communication technologies (ICT), many organizations enlarge their collaborative decision-making processes. Decision makers work together but not necessarily at the same time and at the same place. They are supported by communication systems like email or by Groupware systems, which constitute a kind of electronic infrastructure superposed on hierarchical organizations.

Adam, Brézillon and Pomerol (2004) present the case study of XYZ Publications Ltd, a news organization which publishes two newspapers: a national morning paper and a local afternoon paper. The study was lead to understand the nature of the changes undergone by the firm and to analyze the group dimension of its decision-making processes.

In this paper, we consider the role played by context when the enterprise is considered in term of social network. Organizations are fundamentally information-processing structures (Kunz, Christiansen, Cohen, Jin and Levitt, 1998). In this view, an organization is structured to achieve a

specific set of tasks, and is composed of actors that process information. Thus, the enterprise is like an "information space" with information fluxes between individuals. In parallel, a social network is considered as a complex network of data, information and knowledge, and several virtual communities appear at the different steps of the information-management process corresponding to a series of specific focuses of attention. Our objective is to precise this parallel by considering context explicitly.

There are different heterogeneous contexts (firm context, personal context, board context, external source contexts, etc.) which are at different granularities. The key point is that the complex information flows circulating inside the enterprise can be understood such as information transfers between all these contexts.

Hereafter, the paper is organized in the following way. The next section specifies the terms of context and social network used in the paper. The following section discusses different aspects of context considered as important in our comparison of an enterprise to a social network. We finally conclude by discussing some challenges that open new perspectives.

Some definitions

Context as Three Types of Knowledge

Brézillon and Pomerol (1999) consider three types of context, namely the external knowledge, the contextual knowledge and the proceduralized context. Figure 1 gives a representation of these three types of context.

At a given focus of attention, one distinguishes the part of the context that is relevant at this step and the part that is not relevant. The latter part is called **external knowledge**. The former part is called **contextual knowledge**, and obviously depends on the agent and the current focus of attention.

A part of the contextual knowledge is proceduralized and used at the focus of attention. We call it the **proceduralized context**. The proceduralized context is contextual knowledge that is invoked, assembled, structured and situated according to the given focus. Thus, the focus of attention and its associated context are strongly intertwined.

Contextual knowledge is more or less similar to what people generally have in mind about the term 'context.' Contextual knowledge is personal to an agent and it has no clear limit (McCarthy, 1993). Contextual knowledge is evoked by situations and events, and loosely tied to a task or a goal. When the task becomes more precise, a large part of this contextual knowledge can be proceduralized according to the current focus of attention. Although the contextual knowledge exists in theory, it is actually implicit and latent, and is not usable unless a goal (or an intention) appears as a focus. When an unexpected event occurs, actor's attention is focused on it and a part of the contextual knowledge will be proceduralized accordingly in order to adapt the decision-making process to this new event.
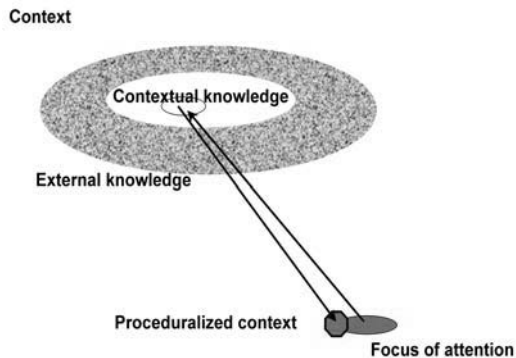

Figure 1: The three types of context

The context has a dynamics (Brézillon, 2003a, 2003b), and this dynamics corresponds to a movement between contextual knowledge and proceduralized context during the evolution of the focus of attention: At each step of the focus, a piece of contextual knowledge enters the proceduralized context or, conversely, the proceduralized context goes back in the body of contextual knowledge and becomes a "chunk of (contextual) knowledge" a la Schank (1982) and this chunk of contextual knowledge can be recalled later as a whole in a new proceduralized context. Thus, the more a person is experimented, the more the person possesses available structured knowledge (i.e. chunks of contextual knowledge that have been used as proceduralized context previously).

When the focus of attention is the affair of a work group, the proceduralized context is built from the bodies of contextual knowledge of all the group members. When the focus moves, the proceduralized context becomes an element of the shared contextual knowledge of the group member. As a consequence, group members reinforce existing their ties (or create new ones), even once the group is dissolved, the task being accomplished.

Definition of a Social Network

A social network is the connection of people by a computer network (Wellman, 1997), and Internet will be the larger social network that we consider in this paper. The main point is that a social network is composed of actors and ties between them (e.g. see Hanneman, 2001). Ties in a social network are numerous and of different natures: familial ties, lifelong friend ties, marital ties, business partner ties, that are important for people to obtain the fundamentals of identity, affection, emotional and material support (Rheingold, 2002), i.e. the recognition of their existence by others. However, the commitment of individuals is superficial, limited to the reasons of local interaction (Foucault, Metzger, Pignorel and Vaylet, 2002). As a consequence, ties in a social network are "socially-oriented" like in the real life (weak ties), trust does not play an important role, and individuals generally belong to several social networks.

The main characteristics of a social network are a flexible structure, a lack of hierarchy, a superficial commitment of actors, which generally belong to several social networks. From an information point of view, any actor in a social network is a receiver/emitter of information, but generally not an information transformer or producer.

A **discriminating factor** allows contrasting the social network with respect to its environment. Thus, a discriminating factor differentiates individuals in a social network and individuals in its environment. For example, registration to a mailing list on a specific topic is to enter a social network where you will find (or may provide) information on the topic, but ties with other members do not matter essentially. Individuals in the social network are called **actors** for differentiating them from individuals in the environment of the social network. However, in terms of information flow, the frontier between the social network (the actors) and its environment (the individuals) is porous.

There exists many discriminating factors and as many social networks as discriminating factors. A discriminating factor does not imply strong ties among actors because a discriminating factor is neither a goal shared by actors of the social network nor a common focus of attention of the actors. For example, a discriminating factor is "Living in France" and all actors in this social network share some common interests on, say, French cooking and wine, but will not act collectively in the same direction for that purpose. Actors in a social network have not necessarily an active role like in a virtual community.

The main difference, which is identified in the literature between a virtual community and a social network, concerns computer-mediated means. The key point is the distinction between the computer-mediated communication concerning either individuals (e-mail, chat, blogs, etc.) or collaborative work (writing, designing, etc.). Clearly the collaborative

decision making is ascribed in this second realm, and then the "focus-oriented" aspect is more important than the "computer-mediated" aspect.

The Information and Communication Technology (ICT) gives an electronic infrastructure on the organization, which is supposed to reinforce the coherence of the virtual community. However, there is more than a difference of infrastructure between a social network and a virtual community. A virtual community is a sub-set of a social network that realizes a collaborative work in order to satisfy a given focus of attention.

A virtual community is a group of actors who have regular contact with one another in cyberspace, with shared interests, problems or ideas (i.e. a shared focus of attention), independently of space and time. A main characteristic of virtual communities is that they are homogeneous and organized networks of individuals with similar attitudes and life-styles (Feld, 1981), and they are intentional formations (Valtersson, 1999). The cohesiveness of the virtual community is given by the **focus of attention** that is shared by all the actors.

The focus of attention gives a structure on the virtual community by defining an organization of roles on the virtual community and a coordination of task execution by actors. It acts like an internal engine to impulse the virtual community. Actors have then a strong motivation in the realization of the focus and each actor assumes an active role to satisfy this process. Thus, actors in a virtual community are "socially interdependent" (Bellah, Madsen, Sullivan, Swidler and Tipton, 1985), not uniquely "socially-oriented" like in the social network. A parallel in the domain of decision making, would allow to say that one may observe only a diluted decision making in a social network and a collaborative decision making in a virtual community.

In a virtual community, the focus of attention affects actors as a glue force that influence ties between actors (directly connected to the focus of attention and the related roles that actors have to play and the corresponding tasks to accomplish), although the virtual community stays primarily a social network and keeps all its characteristics in a context that is strongly related to the focus of attention of the virtual community.

Some Aspects of Context

Lessons Learned in a Case Study

We now consider again the case study introduced at the beginning of the paper and discussed in (Adam and Pomerol, 2001; Adam, Brézillon and Pomerol, 2004). It is important to acquire the information **and** its context for a correct understanding of the information. Information and its context must be considered jointly because the information takes a

meaning within its context, and, conversely, this context is identified with respect to the information.

Actors introduce contextual elements from their individual contexts into the interaction context to build collaboratively a proceduralized context for the solution in the interaction context. Sharing elements does not mean to develop an identical view of the solution for all actors, but to make compatible actors' views on the solution (Karsenty and Brézillon, 1995).

An enterprise, such as the XYZ firm, is assimilated to a social network, the discriminating factor being to belong or not to the XYZ firm. However, the frontier between the social network (i.e. the XYZ firm) and its environment is porous, unpredictable events occurring generally outside the XYZ firm. A first step in the event treatment implies intervention of individuals from outside the XYZ firm (e.g. witnesses) and actors of XYZ (e.g. a reporter). At each step of the information-management process there is a particular focus (with its context) that triggers a working group organized like a virtual community for addressing this particular focus.

Different contexts are associated with elements such as the social network, the virtual communities, the actors, the enterprise, the event, etc. These contexts can be organized in a hierarchy based on the granularity of the contexts such as presented in Figure 2.
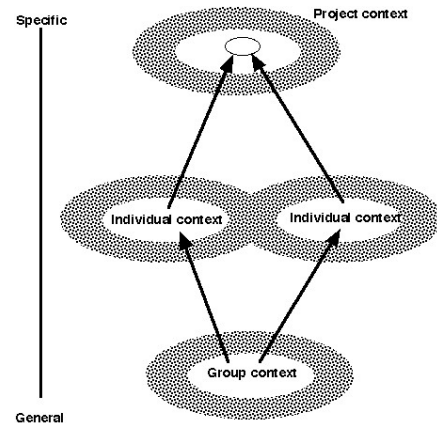

Figure 2: Granularity of contexts

Another lesson learned from the case study is at the level of each context. Let's consider the context of a working group. Its context (as for other contexts) presents two aspects depending on an internal or external viewpoint.

From an internal viewpoint, this "group context" contains contextual knowledge such as the general policies, roles and tasks to accomplish, rules, constraints, objectives. According

to the focus of attention, group actors proceduralize this contextual knowledge within their "individual contexts."

From an external viewpoint, the working group interacts with other entities and thus the group context can be considered as an "individual context" in a larger group (e.g. the firm, a market, an European project, etc.) in which proceduralized contexts are built from contextual knowledge of the larger group.

Context Granularity

As said previously, information circulates across contexts at different levels of generality. At a general level, we distinguish the group context, the individual contexts of the actors at an intermediate level, and at the more specific level, the context of the focus of attention that corresponds to the interaction context in which actors are working collaboratively (see Figure 2).

According to our definition of context given previously, the contextual knowledge at one level is transformed in a proceduralized context at the more specific level. For example, contextual information in the group context could be "find a compromise between a relevant information for the readers of the newspaper and the notoriety of the sponsors of the newspaper." This contextual knowledge in the group context will be proceduralized in the individual contexts of the actors writing the article to give the information, say, without links with the sponsors.

With respect to the notion of social network, context is related mainly to the virtual community, because the proceduralized context is built in a collaborative way by the actors of the virtual community that share a common focus of attention. The focus of attention leads to the construction of a new proceduralized context at each step of its evolution. The saving of the proceduralized context in each actor's context implies that there is a shared context developed progressively among actors. This shared context is developed during actors' interaction in the virtual community when the proceduralized context is built. As a consequence, actors develop ties during this construction of the proceduralized context.

The presentation of a virtual community through its focus of attention and the related context, the proceduralized context that is built, and the ties evolution that results, leads to speak of virtual community as a "contextualization of a social network."

Interaction Context and PC Building

When an unexpected event occurs, a focus of attention appears in a given context. Both focus **and** its context are considered jointly by a group of actors (belonging to a social network) that have a same concern for the focus and are sensible to its context, and thus will interpret the focus with respect to its context. The group constitute a virtual community. The focus induces an organization of tasks to

accomplish and of roles that actors have to play in this community. The actor group becomes assembled, organized and structured and thus is able to realize a real collaborative work.

The transformation of contextual knowledge into a proceduralized context supposes a process of communication between different levels. Figure 3 represents how the proceduralized context (PC) is built from contextual knowledge (CK, and EK representing the external knowledge) in individual contexts of two (or more) actors during their interaction about the given focus of attention. The interaction context contains the pieces of contextual knowledge coming from individual contexts, CK pieces, which will be share by all actors, and finally organized, assembled and structured jointly by all the actors during their interaction to elaborate the proceduralized context needs to address the current focus of attention. Thus, the proceduralized context is the result of a co-construction by the actors of a virtual community. Once the proceduralized context has been exploited at the current focus of attention, it becomes a piece of the shared context of the actors in the virtual community. (This aspect of context is discussed in more details in Brézillon, 2003b.)
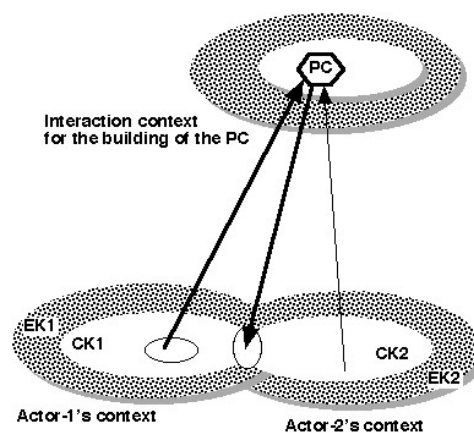

Figure 3: A representation of the proceduralized-context building

A Context-based view of Social Networks

In a previous section, virtual communities are assimilated to contextualization of a social network, with (1) contextualization resulting of the focus-dependent reinforcement of ties among groups of actors and (2) ties reinforcement being developed during the proceduralized-context construction.

As a consequence of the collaborative building of the proceduralized context and the enrichment of the shared context of actors, ties between them being reinforced. Ties are managed at different levels between the actors of the virtual community during this proceduralized-context

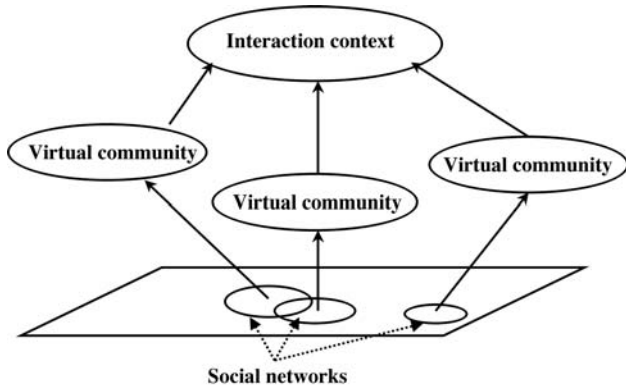construction until its final movement into their shared context.

Figure 4: Parallel between social network and virtual community with context on Figure 2.

This leads to a parallel between both views on context and on social network. Figure 4 presents a situation for a social network and virtual community (virtual communities are represented distinctly from the original social network only for making more readable the comparison) similar to the situation described in Figure 2 for the different types of context. The more the granularity is high, the more the entity is organized and structured. Thus, a proceduralized context (respectively a virtual community) has a higher organization than a body of contextual knowledge (respectively the social network). This parallel is developed in Table 1 which sums up the different points outlined previously in the paper.

AI items	Social items	Nature of items
Contextual knowledge	Social network	Unstructured
External knowledge	Environment	Unstructured
Proceduralized context (PC)	Virtual community	Structured
PC building	Tie reinforcement	Contextualization process
Chunk of knowledge	Chunk of actors	Operational knowledge

Table 1: Parallel between context and social networks

Conclusion and Perspectives

Up to now studies on collaborative work, context, social network, virtual community have been lead separately with any cross-references. In this paper we show that context plays a central role in order to, in the one hand, give a global and coherent view on social network and virtual community,

and, in the other hand, replace collaborative work in a new framework providing a new insight on interrelationships between participants (all coming from a same social network): creating ties being equivalent to build a proceduralized context and the development of a large shared context. This new insight on collaborative work comes from the choice to consider an enterprise as a structure of information flow. This leads to a problem of knowledge management, in which the important point is the management of the transitions between all the different states of the knowledge such as tacit, implicit, individual, collective, etc. (Prax, 2001). Putting all together, the integration of knowledge, content and context management seems to be a new challenge in collaborative work.

A virtual community has a limited life cycle with a birth, a life and an end, which is shorter than the life cycle of the social network. Maybe the most interesting difference between a social network and a virtual community is that the virtual community can be compared to a dissipative structure as discussed some times ago in the living system area (Prigogine, 1969), i.e. a structure that maintains an organization using the flow of energy (the information) that crosses it. Thus a contextualization could be compared to a dissipative structure.

We introduce the notion of "chunk of actors" for describing members of a virtual community, notion that is similar to the notion of chunk of knowledge a la Schank (1982). This introduces a dynamic dimension to collaborative work apparently not considered explicitly before, and related to the process of contextualization in both cases.

Even in the unique domain of social network and virtual community, the view presented in this paper is a challenge. First, the view of a virtual community as a contextualization of a social network to address a given focus of attention is not usual in the literature. This is shown in another domain (Brézillon, 2003a) with practices representing contextualization of the procedures established by the enterprise in order to address the specificity of the contextual cues of the situation (the focus of attention). Second, the evolution of a focus of attention corresponds to a series of contextualizations of a social network for dealing with different steps of the global focus of attention. Three, a large project (e.g. an European project) can lead simultaneously to the birth of several virtual communities acting in parallel on parts of the problem to solve (e.g. the work packages).

Indeed, making context explicit allows the distinction between virtual community and social network such as a first approximation. We explore now this path by reasoning in terms of levels (e.g. community level) and we study a four-level model for representing any organizational entity in (Gachet and Brézillon, 2005).

References

Adam, F. and Pomerol, J.-Ch. 2001. Revolutionizing decision making with IT in the newspaper industry or not?, *Journal of Decision Systems*, Special issue on Decision Making in Action, 10(2), 289-306.

Adam, F., Brézillon, P. and Pomerol, J.-Ch. 2004. Collaborative applications for supporting complex group decision making. *Journal of Decision Systems*, Special Issue on "Case Studies in Decision Maling and Decision Support in a Complex World". P. Humphreys and D. Sammon (Eds.).

Bellah, R., Madsen, R., Sullivan, W. M., Swidler, A., and Tipton, S. M. 1985. *Habits of the heart: Individualism and commitment in American life*. Perennial Library (Reprint. Originally published: Berkeley: University of California Press.

Brézillon, P. 2003a. Representation of procedures and practices in contextual graphs. *The Knowledge Engineering Review*, 18(2): 147-174.

Brézillon, P. 2003b. Context dynamic and explanation in contextual graphs. In: *Modeling and Using Context (CONTEXT-03)*, P. Blackburn, C. Ghidini, R.M. Turner and F. Giunchiglia (Eds.). LNAI 2680, Springer Verlag Verlag (http://link.springer.de/link/service/series/0558/tocs/t2680.htm), pp. 94-106.

Brézillon P and Pomerol J-Ch. 1999. Contextual knowledge sharing and cooperation in intelligent assistant systems. *Le Travail Humain*, 62(3): 223-246.

Feld, S. 1981. The Focused Organization of Social Ties. *American Journal of Sociology* 86: 1015-35.

Foucault, B., Metzger, J.-L., Pignorel, E., Vaylet, A. 2002. Les réseaux d'entraide entre apprenants dans la e-formation : nécessité et efficacité ? *Education Permanente*, n° 152, p.

95-105.   http://alex.espace-competences.org/Auteur.htm?numrec=061959413913120

Gachet, A., and Brézillon, P. 2005. Task forces as contextualizations in the entreprise, *Revue d'Intelligence Artificielle*, Special Issue on "Modeling and Retrieval of Context", S. Schultz, T. Roth-Berghofer & P. Brézillon (Eds.) (to appear).

Hanneman, R.A. 2001. *Introduction to Social Network Methods*. Online textbook, Department of Sociology, University of California, Riverside. http://faculty.ucr.edu/~hanneman/SOC157/NETTEXT.PDF

Karsenty, L. and Brézillon, P. 1995. Cooperative problem solving and explanation. *Expert Systems With Applications*, **8**(4): 445-462.

Kunz, J.C., Christiansen, T.R., Cohen, G.P.Jin, Y. and Levitt, R.E. 1998. The virtual design team. *Communications of the ACM*, 41(11): 84-91.

McCarthy, J. 1993. Notes on formalizing context *Proceedings of the 13th IJCAI* Vol.1, pp 555-560.

Prax, J.-Y. 2001. Le rôle de la confiance dans la performance collective. http://www.polia-consulting.com/default/EN/all/publications/p1051707635697.htm

Prigogine, I. 1969. Structure, Dissipation and Life. *Theoretical Physics and Biology*, Versailles, 1967. North-Holland Publ. Company, Amsterdam.

Rheingold, H. 2002. Chapter 11: Rethinking Virtual Communities. Developing a sense of Place. *Proceeding of the Richard A. Harvill Conference on Higher Education*.

Schank, R.C. 1982. *Dynamic memory, a theory of learning in computers and people* Cambridge University Press.

Valtersson, M. 1999. *Virtual communities*. http://www.informatik.umu.se/nlrg/valter.html (last visit: 21/04/04)

Wellman, B. 1997. An electronic group is virtually a social network. In Kiesler, S. (ed.), *Culture of the Internet* (pp 179-205). Mahwah, NJ: Lawrence Erlbaum.