Computer-supported cooperative work — and learning

Invited paper

'Travail coopératif et NTIC en environnements ouverts de formation'
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The areas of computer-supported cooperative work (CSCW) and computer-supported cooperative learning (CSCL) have co-existed next to each other for a long time. The co-existence has been a peaceful one, but then again, the relationship between the two fields has been characterized by little interaction.

It might therefore be timely to consider if this state of affairs is as it should be.

Some researchers believe that the two fields overlap to a very large extent, if not totally. They point to the fact that the two fields deal with issues of concerted human interaction and communication mediated by the same repertoire of basic computer-based technologies. Others believe that the two fields, in spite of these similarities, address rather different issues. I'm of the latter persuasion. In the following I will give my reasons for believing so.

At the same time, however, I will point to issues of mutual interest to the two fields. I will conclude by addressing the challenge of internet-based education.

Diverging concerns

Cooperative work is usefully conceived of in terms of actors' *interdependence* in doing their work (Schmidt and Bannon, 1992). If cooperative work is conceived of this way, the focus is on *the practices* by means of which actors align, integrate, mesh etc. their distributed and yet interdependent activities; that is, the focus is

coordinative practices: the procedural, technical, and organizational techniques and methods through which concerted action is accomplished.

By focusing on coordinative practices, this conception of cooperative work (and by implication CSCW) relegates other aspects of cooperation to the background. In particular, the issue of discordant interests and motives among actors is of minor concern if one is addressing coordinative practices and problems in a typical work setting: Actors are interdependent in their work and getting the job done therefore is in everybody's interest. Mutual help is taken for granted and is a matter of fact (Heath and Luff, 1992; Harper and Hughes, 1993; Heath and Luff, 1996, 2000).

From other perspectives, however, issues of interests and motives are of primary concern (Schmidt and Bannon, 1992). Such perspectives can, of course, be applied to cooperative work as well, but are particularly pertinent in other kinds of settings than the typical work place. For example, in building interactive information systems that are to support 'common information spaces' that bridge heterogeneous communities or cut across otherwise unrelated communities one would most certainly have to take into account such issues, since contributors/users are not interdependent in their work and therefore don't have this overriding shared interest in getting the job done (Orlikowski, 1992). This applies to the domain of teaching as well.

Secondly, in a typical cooperative work setting, *the work is an everyday thing, it is mundane and routine*. This does not mean that work is done 'automatically' or mindlessly, but rather that *it is something actors do day in and day out.* They know the domain; they have developed sophisticated skills; they understand what colleagues are doing, why they are doing it, and what it means; they know each other and each other's competencies, weaknesses, and responsibilities, and they thus typically know what to expect and routinely anticipate events and troubles. They take for granted that certain procedures are followed by their colleagues, that certain criteria are applied, that certain perspectives are employed, and so forth. *Making sense is effortless* (Heath and Luff, 1992; Harper and Hughes, 1993; Heath and Luff, 1996, 2000; Schmidt, 2000).

In heterogeneous communities and other kinds of diffuse 'common information spaces', by contrast, actors typically struggle to make sense of what is going on.

This again applies to the domain of teaching as well. In fact, a teaching situation is fundamentally characterized by the fact that one party (the students) are not experienced, they are truly novices. They struggle to develop the required competencies, to make sense of it all. They are not yet members of the particular community of practice, they are rather being introduced to it

Furthermore, the student populations of educational institutions are diffuse and transient communities, as opposed to communities of practice, and the conditions under which 'shared' knowledge develops (i.e., relatively stable membership of a

community constituted by objective interdependence and shared practices) are largely absent.

Thirdly, and finally, the coordinative practices by means of which cooperative work is articulated are part and parcel of actors' practical competencies. It is because they know the work that they are able to make sense of what colleagues are doing.

It goes without saying that the universal competencies of human adults such as the abilities to conduct face-to-face conversations and also the culturally specific competencies ordinarily expected of adults in developed industrial societies (literacy, arithmetic, knowing the clock, punctuality, conducting encounters and meetings, etc.) are generally and tacitly relied in the coordination of cooperative work as they are taken for granted in other aspects of social life. However diligent a person might be in these social skills, no actor is able to participate effectively in a cooperative effort without a deep understanding of the work domain in question. Coordinative practices are not generic behavior (like speech) but aspects of domain-specific practices.

Computer-mediated communication (CMC) facilities such as email, conferencing systems, file sharing facilities, media spaces, etc.[1] are therefore typically of limited utility in cooperative work. For computational facilities to effectively support coordinative practices, the coordination support facilities must be integrated with the artifacts by means of which workers do the work: in the process control system of the control room, in the CAD system of the engineers, in the workflow and archive system of the administrative agency, etc.

Learning to use such computational facilities that are designed as integral parts of domain-specific applications, to support domain-specific coordinative practices, will require not only that students are familiar with the applications but also that they (to a significant degree) have developed the routines that enable them to effortlessly make sense of what other are doing.

I therefore believe that the division of labor between CSCW and CSCL is rational. Mixing up the two fields would only create confusion.

Converging concerns

Now, having said that the concerns of the two fields are clearly diverging, it is important to note that there are areas where CSCW and CSCL intersect conceptually and in terms of issues, and where the fields have to interact, not only to sort out their businesses but also to improve the utility of the technologies and methodologies that are being developed.

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1 For literature on these technologies, cf. (Hiltz and Turoff, 1993; Finn, Sellen, and Wilbur, 1997).

Learning in cooperative work

Learning is inexorably an aspect of working. Individuals develop their skills and competencies as part of and in the course of their productive activities. Any CSCW system should take this fundamental fact into account, by offering differential interactional modalities to different actors. Learning as a central aspect of working is therefore an issue of great import for CSCW. In fact, CSCW researchers generally conceive of skills, not as innate abilities but as socially situated competentices (cf., e.g., Suchman, 1987; Resnick, Levine, and Teasley, 1991; Button, 1993; Button et al., 1995; Resnick et al., 1997; Heath and Luff, 2000) and consequently do not make a sharp distinction between working and learning, as witnessed by the important role played by frameworks such as Activity Theory (cf., e.g., Engeström, 1987; Kuutti, 1991; Nardi, 1997), Distributed Cognition (cf., e.g., Hutchins, 1991), and Communities of Practice (cf., e.g., Lave, 1988; Chaiklin and Lave, 1996; Wenger, 1998), which all focus on issues of skill and learning in everyday action and interaction and on the social organization of learning and skill.

Furthermore, collective working practices — including coordinative practices — develop over time, as routines, procedures, division of labor, conceptualizations, etc. are continually attuned and refined. CSCW systems should therefore be designed with support for learning in mind. Actors should be supported in expressing their evolving practices (routines, conventions, procedures, classification schemes, etc.) in computational systems. This may sound fairly straightforward but the fact is that it raises very fundamental conceptual and technical issues (cf., e.g., Schmidt and Simone, 1996). These conceptual and technical problems are of course beyond the scope of this paper. The point I'm trying to make here is simply that learning is an integrated aspect of cooperative work and that CSCW could thus have much to learn from CSCL.

Cooperative work in learning

In many educational institutions, novel forms of educational organization are being explored, more or less experimentally, mostly in the shape of project-oriented learning based on group work, as opposed to class-room styles of organization. These organizational forms are normally motivated by a desire to overcome the alienation experienced by students in conventional educational institutions. The project-oriented forms of learning are also motivated by the perceived need to prepare students for 'team work' in their professional careers.

Before I proceed, two things need to be pointed out. Firstly, as a CSCW researcher I'm not an expert in didactic theory. My observations in the following on cooperative forms of learning in educational institutions are mostly based on my own experiences as a teacher at Roskilde University Center in Denmark from the establishment of the

university in 1972 until I left the university in 1985. In this period a large scale — and often dramatic — experiment with radical forms of learning organized on the basis of project-oriented group work was undertaken. Learning at RUC is still to a large extent organized as project-oriented group work but this form is now supplemented by more conventional forms of course-based teaching.

Secondly, the new forms of learning should not be mistaken for the many forms of group work that one will find in most contemporary universities and other educational institutions. Group work is here typically merely an addition to and embedded within conventionally organized education, very often motivated by a desire to reduce the work load on teachers, for instance, by making ‘strong’ students help ‘weaker’ students. In these institutions, cooperative work is not an inherent requirements of the nature of the task but is externally imposed and enforced. The very fact that work is organized as group work is often even experienced as an additional burden by the participants. It is contrived group work.

Anyway, the emerging organizational forms of learning are often genuinely cooperative, in that the task to be solved by the group actually requires the concerted effort of multiple students (who are thus interdependent in their project work). In so far as that is the case, the cooperative learning process will require CMC technologies in the same way and to the same extent as cooperative work in production or design or administration or the public domain in general.

However, as argued above, as domain-specific CSCW applications become part of the workplace, it becomes necessary for students to learn to use such systems as part of their learning other domain-specific skills and competencies. That is, modern cooperative learning must integrate appropriate CSCW systems as part of the technological foundation of the educational set-up. On the other hand, and as also argued above, the extent to which domain-specific CSCW applications can be used effectively by project groups depends on the domain skills of the members. In other words, the conclusion made above, that CSCW systems in the workplace must allow for and support the learning processes of workers, applies equally well to the issue of CSCW in education.

In short, the issue of designing CSCW systems so as to support learning as an integrated part of working turns out to be identical to designing CSCW systems so as to support their use in cooperative learning. Again the concerns pf CSCW and CSCL intersect, if not in theory, then in practice.

The challenge of ‘virtual’ universities

The very fact that this workshop is hosted by the Universitat Oberta de Catalunya makes it imperative for me to finally address the prospects of the vision of a ‘virtual’ or rather internet-based university.[2]

Like the ‘open university’, the internet-based university has some obvious advantages over a university localized in a building, in a complex of buildings in a city center, or in a campus, in that it eliminates the economic, social, psychological etc. costs of moving to other cities and it thus facilitates life-long learning. The costs, on the other hand, are equally obvious, as it may reproduce and even increase the alienation of conventional mass universities and, of course, has relatively large organizational overhead (technical support etc.),

Now, what are the prospects for cooperative technologies such as CMC and CSCW technologies in the new forms of educational institutions that are emerging and in which the radical forms of cooperative learning are combined with a dissolution of the classical form of localized educational organizations in which teachers and students cohabitate the same building or the same campus? Is it possible to develop cooperative practices in such highly dispersed student populations?

Before I, tentatively, venture to discuss this question, please allow me to make a few comments on the concept of learning. Very crudely put, the learning process involves development of competencies in two rather different respects: On one hand learning as the gaining of experience and becoming diligent (through ‘training’) in applying methods, concepts, theories, and on the other hand learning as socialization, becoming a member (‘apprenticeship’).

Whereas internet-based universities undoubtedly can compete with conventional universities in many disciplines in terms of training certain skills and conceptual development, it is less certain if such universities can offer the socialization that is part of all education, not least higher education.

Socialization of individuals as a member of a profession involves, inter alia, the adoption of the concerns, values, criteria, priorities, etc. of the particular discipline as well as the development of the perspectives in which these concerns are expressed (that is, learning to make *x* problematic and to take *y* for granted). Sociologists use the term ‘social bonding’ to refer to the processes through which such values and perspectives are developed by members and acquired by novices, and they often take for granted that social bonding involves very rich informal modes of interaction, typically in focused or face-to-face encounters.

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2 Nobody has ever seen or touched a university or an organization for that matter, so there is nothing ‘virtual’ in physical distance between members of the organization. Hence the inverted commas around the word ‘virtual’.

Even more than the open university, the internet-based university relies on the premise that professional socialization can occur remotely, without any access to 'natural' interaction? Academic socialization without the students ever meeting and getting to know the teacher and each other? Without the bodily presence that allows the listener or reader to freely consult the speaker or author as to how the text is to be taken, its illocutionary force? Without embodied, materially situated interaction? Really?

Before rejecting the possibility and hence the very idea of an internet-based university, let us pause and reflect.

There are good reasons to expect that sociologists and social psychologists, in presuming that socialization *requires* focused, localized interaction, are unduly generalizing the obvious fact that such interaction is crucial for socialization in the family and plays an important role in many other forms of socialization.

One only has to point to the fact that, during the last 6000 years or so, civilizations have developed a wide range of techniques and practices that allow competent actors to project speech acts and other emotions over distance in time and space to other competent actors.

The techniques of writing and reading are of course the case in point. I'm not only referring to basic literacy but also and specifically to the development of sophisticated practices (grammar, punctuation, vocabulary, genres) for representing illocutionary force in a text (Olson, 1994). By virtue of these culturally developed practices, a competent novelist or poet is able to project not only simple statements about factual matters but sensations, feelings, anxieties, etc. to his or her readers. Similarly, scientists who master the sophisticated rhetorical practices of scientific writing convey their concerns and norms to other scientists. Or to take a perhaps even more striking example, the technique of representing music graphically enables appropriately trained people who can read music to experience the music emotionally without ever having heard it. One only has to point to novel techniques such as the development of movies and recorded music to make it patently obvious that the social bonding by the projection of emotion to interlocutors is not at all restricted to face-to-face interaction but rather relies on a repertoire of culturally developed and mediated practices. Socialization, in our civilization, involves a very complex interplay of 'virtual' and 'real-world' communication and interaction.

In fact, some individuals master subtle but highly effective techniques of forming the values (aspirations, criteria, priorities) of remote audiences, that is, techniques of 'remote socialization', as it were, as in the case of statesmen, philosophers, etc. As of now, these techniques are far from understood and quite elusive, but there is no reason to rule out that such techniques could be investigated and learned, just like novelists and composers now learn techniques of representing intentionality in texts and scores.

In conclusion, then: Instead of ruling out the very possibility of academic socialization in internet-based universities, we need to investigate and further develop the techniques of representing illocutionary force in this new medium. It is as if we have only yesterday invented the printing press and now have to develop the language, the syntax, the stylistic schemes of modern prose. Our task is as daunting as that but probably not more difficult. For CSCW and CSCL, this is a shared challenge.

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