

CSCW: Four Characters in Search of a Context*

Liam J. Bannon
Dept. of Computer Science
Aarhus University
Ny Munkegade
DK-8000 Aarhus C, Denmark

Kjeld Schmidt
FCI Informatics Research Center
Buddinge Hovedgade 80
DK-2860 Søborg, Denmark

Abstract

The title of this paper was chosen to highlight the fact that the label CSCW, although widely adopted as the acronym for the field of Computer Supported Cooperative Work, has been applied to computer applications of very different ilk. It is not at all clear what are the unique identifying elements of this research area. This paper provides a framework for approaching the issue of cooperative work and its possible computer support. The core issues are identified and prospects for the field are outlined.

What's in a name? And does it really matter, after all? In some sense, in the great scheme of things, names don't matter that much in many situations. As long as we all know what is designated by the name, the term itself is of minor importance. However, we should occasionally examine the assumptions that may be implicit in the name. For instance, in the song "A boy named Sue", the name did matter! Likewise, the name 'Artificial Intelligence' (- "the Very Idea!" as the philosopher John Haugeland notes in the title of one of his books), implies a certain view on the nature of "intelligence", so also with the term "Expert Systems". In the same vein, the name 'Office Automation' promised to automate office work, a project since deservedly denounced as ludicrous and ultimately abandoned as unattainable. Do we have similar problems with the name Computer Supported Cooperative Work?

1. What is CSCW?

In a recent seminar, Irene Greif (1988b), one of the originators of the term 'Computer-Supported Cooperative Work' (together with Paul Cashman), commented that they coined the phrase partly as a shorthand way of referring to a set of concerns about supporting multiple individuals working together with computer systems. The meaning of the individual words in the term were not especially highlighted. With the subsequent abbreviation of the term Computer

* With apologies to Luigi Pirandello, author of the play "Six Characters in Search of an Author".

Supported Cooperative Work to that of CSCW, attention to the individual words was expected to be even further reduced, as the field would come to be represented simply by the acronym. This has not occurred. This may be in part due to the fact that the boundaries of the field are difficult to circumscribe and that a core definition of the field does not exist, - other than the very descriptive one of CSCW being a field which covers anything to do with computer support for activities in which more than one person is involved.

If we take this extremely broad categorization of the field, it is hard to see how anything of the form of a coherent research area can emerge from such a loose description. However, as noted by Bannon et al. (1988), having CSCW simply as an "umbrella term" could be advantageous:

"What at first sight might appear to be a weakness of the field, having such a diversity of backgrounds and perspectives, is seen by us as a potential strength, if utilized properly. We believe that for the moment the name CSCW simply serves as a useful forum for a variety of researchers with different backgrounds and techniques to discuss their work, and allows for the cross-fertilization of ideas, for the fostering of multi-disciplinary perspectives on the field that is essential if we are to produce applications that really are useful".

Granted that this interdisciplinary commingling has already occurred, the time may now be ripe for a more incisive probe of what the conceptual underpinnings of the field might be. Already at the 1988 CSCW Conference one could sense a certain tension among the participants, which we believe was generated by the lack of a shared perspective on the field.

1.1. The Crux of CSCW

According to the British sociologist of science, Richard Whitley, a research area is defined by a *problem situation*: "A research area can be said to exist when scientists concur on the nature of the uncertainty common to a set of problem situations" (Whitley, 1974).

Applying this criterion to our topic, we may ask what are the problem situations addressed by researchers working under the CSCW label? Are the problem situations in fact related? Do scientists in the area actually concur on the uncertainty common to this set of problem situations? Are they exploring the same basic issues? This is questionable when one notes that studies formerly appearing under the rubric of Office Information Systems or Computer Mediated Communication now appear under the CSCW banner.

Indeed, unpacking the individual characters in the term, the "CW" or "Cooperative Work" aspect has itself come under some scrutiny. What does it mean? Collaborative work, collective work, group work, cooperative work: do the distinctions matter for our purposes? Well, to the extent that we are supposedly trying to support "it" with computers, it probably would be a good idea to know what we are talking about, as certainly at present the label seems to be applied to just about anything, like face-to-face meeting facilitation, desk-top presentation, project management, multi-user applications, text-filtering software, electronic mail, computer conferencing, hypertext, etc.

Even if we have some shared notion of what "cooperative work" is, what is the role of "CS", of "Computer Support" for this activity? Today, performing cooperative work through the medium of the computer can be an extremely trying and exasperating experience. It has been said that what we have to be concerned about in thinking of computer technology with respect to cooperative work is not

the "support" notion, but first of all ensuring that the computer does not *disrupt* the collaborative activity that is already going on!

CSCW cannot be defined in terms of the *techniques* being applied. CSCW is a research area aimed at the design of application systems, and like any other application area CSCW, in its search for applicable techniques, potentially draws upon the whole field of computer science. What unites CSCW is *the support requirements of cooperative work*. Accordingly, a technology-driven approach to CSCW will inevitably dilute the field. To some extent, the current lack of unity of the CSCW field bears witness to that.

CSCW should be conceived as an endeavor to understand the nature and characteristics of cooperative work with the objective of designing adequate computer-based technologies. That is, CSCW is a research area addressing questions like the following: What are the specific characteristics of cooperative work as opposed to work performed by individuals in seclusion? What are the reasons for the emergence of cooperative work patterns? How can computer-based technology be applied to enhance cooperative work relations? How can computers be applied to alleviate the logistic problems of cooperative work? How should designers approach the complex and delicate problems of designing systems that will shape social relationships? And so forth. The focus is to *understand*, so as to *better support*, cooperative work. Let us now clarify the concept of cooperative work itself.

1.2. The Target Area of CSCW: Cooperative Work

'Cooperative work', the term picked by Greif and Cashman to designate the application area to be addressed by the new field, happens to be a term with a long history in the social sciences. It was used as early as the first half of the 19th century by economists as the general and neutral designation of work involving multiple actors (e.g., Ure, 1835; Wakefield, 1849) and was picked up and defined formally by Marx (1867) as "multiple individuals working together in a planned way in the same production process or in different but connected production processes." In this century, the term has been used extensively in the same general meaning by various authors, especially in the German tradition of sociology of work (e.g., Popitz et al., 1957; Bahrtdt, 1958; Dahrendorf, 1959; Kern and Schumann, 1970; Mickler et al., 1976), as well as by other authors (e.g., Miller and Form, 1964; Thompson, 1967).

There are many forms of cooperative work, and distinctions between such terms as cooperative work, collaborative work, collective work, and group work, are not well established in the CSCW community. Without wishing to impose a formal taxonomy on a set of terms that have loosely defined everyday connotations, we believe that analyzing the meaning of cooperative work is necessary due to the wildly disparate uses of the term in the field at present. For instance, for Ehn (1988) *all work* is essentially cooperative, in that it depends upon others for its successful performance. Taking this stance would seem to imply that there is no additional clarification achieved by adding the term 'cooperative' to that of 'work'. At another extreme, Sørgaard (1987) has a very specific set of criteria for what would count as cooperative work, for instance, that it is non-hierarchical, non-specialist, relatively autonomous, etc. From yet another perspective, e.g. that of Howard (1987), the term 'cooperative work' is inappropriate because of the ideology inherent in the term, a 'too sweet' label for the realities of everyday work

situations. He prefers an allegedly more open term, 'collective work', which he sees as being induced in a variety of ways through the use of computers in general. Kling (1988) concurs, arguing however for the more open, if not exactly neutral, term 'coordinated work'.

Replacing the term 'cooperative work' with that of 'group work' or defining the former by the latter does not help much. Greif, in an introduction to the field (1988a), claims that CSCW is an "identifiable research field focused on the role of the computer in group work". The term 'group' is quite blurred and is often used to designate any kind of social interaction. For instance, in his book on *Groupware*, Johansen (1988) mentions "teams, projects, meetings, committees, task forces" etc. as examples of "groups" and even includes interaction among workers, supervisors and management in manufacturing operations, "often across both distances and work shifts", under the same notion.

Generally, however, a group is defined as a relatively closed and fixed ensemble¹ of people sharing the same 'goal' and engaged in incessant and direct communication. The notion of a shared goal is murky and dubious, however. The cooperative process of decision making in a group is a very differentiated process involving the interaction of multiple goals of different scope and nature as well as different heuristics, conceptual frameworks, etc. We will revert to this point later in this paper. For now, the informal definition suggested by Bahrtdt (1984) will do: we will use the term 'group' if its members perceive themselves as a "we". This usage is in accord with daily usage of the word 'group'. Even with this, more relaxed, definition of 'group', however, the notion of group work does not encompass the rich and complex reality of cooperative work. As pointed out by Popitz and associates in their classic study (1957), the group is not the specific unit of cooperation in modern industrial plants. Here, cooperation is typically mediated by complex machine systems and often does not involve direct communication between agents. The workers operating a rolling mill in a steel plant, for example, cooperate by monitoring and adjusting the state of the machine system. They are often not constituted as a "group" and they often interact without communicating in the sense of symbolic interaction. Likewise, in various domains, for instance administrative work, engineering design, and scientific research, actors often cooperate at "arm's length", without direct communication and without necessarily knowing each other or knowing of each other, via a more or less *shared information space*, that is, a 'space' comprising data, personal beliefs, shared concepts, professional heuristics etc.

So, the concepts of "group" and "group work" designate specific types of cooperative relations characterized by shared responsibilities. In some cases, groups are formed spontaneously in response to the requirements of the situation. In a hospital, for instance, a group ("task force") is formed on an *ad hoc* basis to deal with an emergency situation. In other cases, groups have a quasi-permanent character like, for instance, project teams. While such situations do belong to the problem situations addressed by CSCW, we certainly do not want to restrict the scope of CSCW to those cases where the responsibility of performing a task has been allocated to or assumed by a relatively closed and fixed collective.

¹ The term "ensemble" has been used by Sartre (1960) to designate an, as yet, unstructured aggregation of people; we use it as a neutral and general designation of the set of people engaged in a cooperative undertaking that does not imply any specific organizational form.

Cooperative work is constituted by *work processes that are related as to content*, that is, processes pertaining to the production of a particular product or service.² In contrast to the spontaneous linking of interrelated production processes via an anonymous market, cooperative work relationships are characterized by being planned or rather premeditated.

Cooperative work comprises *indirect* as well as *direct* and *distributed* as well as *collective* modes of interaction. Work conducted *collectively*, by a group, is merely one specific mode of cooperative work. Cooperative work may also be conducted in a *distributed* manner, i.e., by an ensemble of semi-autonomous workers changing their behavior as circumstances change and planning their own strategies. Furthermore, cooperative work may be conducted *indirectly*, i.e., mediated by the changing state of the transformation process, or *directly*, i.e. by means of interpersonal communication.

The concept of cooperative work does not imply a particular degree of participation or self-determination on the part of the workers, nor a particularly democratic management style. Actually, the concept has historically been developed and used in analyses of the harsh realities of industrial life (e.g., Ure, 1835; Marx, 1867; Popitz et al., 1957). Nor are we saying, "Thou shalt cooperate!"; cooperative work is not better, or worse, than individual work. It is merely technically necessary or economically beneficial in certain work environments.

Work having multifarious facets, it is no wonder that multiple, more or less synonymous terms abound: collective work, collaborative work, coordination, articulation work etc. We do not have to abstain from using any of these terms. They all have different connotations and designate different types or facets of cooperative work. The term 'collective work', for instance, designates cooperative work where the cooperating ensemble is sharing the responsibility for accomplishing the task. The emphasis of the concept is the fusion of the members of the ensemble into a whole, a 'collective'. That is, the term is conceptually close to 'group' and 'team' work. The term 'collaborative work', on the other hand, gives special stress to a particular 'collaborative' or complying spirit among the cooperators, as evident, for example, in the expression "collaborating" with an enemy.

In sum, the term "cooperative work" is the general and neutral designation of multiple persons working together to produce a product or service. It does not imply specific forms of interaction or organization such as comradely feelings, equality of status, formation of a distinct group identity etc. Hence, unlike research areas like Artificial Intelligence and Office Automation, the name of our field is quite pertinent.

2. Perceptions of the CSCW field

Within the field of CSCW, loosely construed, one can find a number of different perspectives adopted by researchers. Howard (1988) coined the term "strict

² Thus, the boundaries of cooperative work networks are defined by actual cooperative behavior and are not necessarily congruent with the boundaries of formal organizations. A cooperative work process may cross corporate boundaries and may involve partners in different companies at different sites, each of the partners producing but a component of the finished product. On the other hand, a corporation may have multiple cooperative work processes with no mutual interaction.

constructionists" to describe those in the field focused on the development of computer systems to support group work, and he noted their tendency to use themselves as objects of analysis in the provision of support tools. These people, mainly implementers, are interested in building widgets, and they see the area of CSCW as a possible leverage point for creating novel applications. Most of these people equate the CSCW field with Groupware. What is Groupware? In a relatively straightforward fashion, it can be defined simply as software that supports groups. There are a number of problems with accepting this terminological sleight of hand. First of all, the Groupware label explicitly limits the attention of CSCW to 'groups', with all the ensuing problems discussed above.

People working on Groupware have a focused goal, namely to design new widgets that might support teams or groups. On the down side, however, often the focus is only on supporting the design group itself, 'widgets for the boys', so to speak. Generalizing from one's own research setting to settings in the "real world" can be fraught with problems, as many researchers have learned to their cost. The Groupware community does this because it is unashamedly technology-oriented. It does not need to understand the application area. It focuses on solving the technical problems of providing multiple-user facilities for any application program (database, word processor, calendar, etc.) and can be viewed as an extension of the user interface to cater for multiple users (Greif, 1988b). Thus, perhaps Greif (1988b) is correct in viewing Groupware as a passing fad, or phase, in that all software in the future will be Groupware to the extent that it will support cooperative work patterns, e.g., word processors facilitating joint authoring, just as state-of-the-art software is now 'user friendly'.

To summarize, we reject the equation of Groupware with CSCW because of its technological focus and its narrowness in the face of the multiplicity of social forms of cooperative work manifest in the world.

Howard (1988) has labelled the remainder of the field, the larger part, as "loose constructionists", a heterogeneous collection of people, some of whom are drawn to the area due to their dissatisfaction with current uses of technology to support work processes, others because they see in this area a chance for groups who traditionally have not had a voice in the design of computer systems to have one. Some wish to make the design of computing systems more democratic, so that the resulting systems will actually support cooperative working, rather than hinder it, where the word 'cooperative' here has a positive value associated with it, connected with workplace democracy. Part of the rationale here is that for truly 'cooperative' work, in their sense, one should design systems in a cooperative manner, and ways of achieving this need to be investigated, tried out, and propagated. So a focus is on alternatives to traditional systems and systems design, alternative ways of doing design, of involving users, etc. (see, e.g., Ehn and Kyng, 1987; Kyng, 1988; Bødker et al., 1988). Howard believes that many in this group focus ultimately too much on the *design* of technology, in a sense believing if we get the technology right, then cooperative working will follow. He believes that the problem is not so much that computer systems do not support cooperative work, or that computers disrupt it, but rather that they induce or compel a "collectivization" of work in ways that we do not fully understand, and it is this process that needs to be understood and should serve as the basis for a scientific discipline of CSCW.

Yet another group, not explicitly identified in Howard's analysis, though some would fit in his second category, are those social scientists interested in studying the use of novel CSCW applications and also showing how their kinds of analyses

of group processes (with or without mediating technologies) might affect the future design of CSCW systems. Some of this work has the air of "what social science can do for you" about it, without much idea of exactly how these insights might be useful in the design of useful CSCW systems, though others are more directly attempting to apply their insights in design teams.

3. Core Issues for CSCW

Whereas Groupware addresses the technical problems of enhancing the human-computer interface by providing multiple-user facilities for, in principle, any application program, CSCW needs to address the following specific requirements of cooperative work:

- articulating cooperative work;
- sharing an information space;
- adapting the technology to the organization, and *vice versa*.

In our opinion, meeting these requirements constitute the core issues of the CSCW field.

3.1. Supporting Articulation Work

Any cooperative effort involves a number of secondary tasks of mediating and controlling the association of individuals. First, tasks are to be allocated to different members of the cooperating ensemble: which worker is to do what, where, when? Second, by assigning a task to a worker, that worker is rendered accountable for accomplishing that task according to certain criteria: when, where, how, how soon, what level of quality, etc. Finally, in the terminology suggested by Strauss (1985), cooperative work requires 'articulation work': The numerous tasks, clusters of tasks, and segments of the trajectory of tasks need to be meshed. Likewise, the efforts of individuals and ensembles need to be meshed. In the words of Gerson and Star (1986), articulation consists of all the tasks needed "to coordinate a particular task, including scheduling subtasks, recovering from errors, and assembling resources."

In work environments characterized by task uncertainty, due to, e.g., an unstable or contradictory environment, task allocation and articulation cannot be planned in advance. In these work environments task allocation and articulation is negotiated and renegotiated more or less continuously. This has been demonstrated very convincingly in the domain of office work.

The commonly accepted view of what constitutes an office still relies heavily on the traditional bureaucratic model: people who perform a number of tasks according to a set of well-specified 'procedures' that have been developed by management as efficient and effective means to certain ends. In this model, many assumptions are made about the rational basis for action, and the common goals of the employees within the organization. The traditional formal organization chart is presumed to show the actual lines of authority and the "correct" pattern of information flow and communication. Despite many studies, dating as far back as the First World War, by industrial sociologists and others pointing to the existence of informal networks of communication (the "grapevine") and of informal groups that affect organizational activity by controlling information and coordinating work output, the early computer systems developed to "automate the office" were built by designers

who implicitly assumed much of the traditional office model. Designers were "automating a fiction" as Beau Sheil (1983) so aptly put it.

Such systems have now been admitted as failures (Lyytinen & Hirschheim, 1987). Researchers and practitioners are beginning to appreciate the inherent complexity of supposedly 'routine' tasks and the difficulty of capturing the tacit knowledge and "day-to-day" informal practices of office workers. More recent studies, performed by anthropologists and sociologists, have emphasized the rich nature of many allegedly 'routine' activities in the office and the complex pattern of decision-making and negotiation engaged in by co-workers, even at relatively 'low' positions within the organization (Wynn, 1979; Suchman, 1983; Gerson and Star, 1986). Suchman (1983) gives a concise account of this discrepancy between the office procedures that supposedly govern office work and the practical action carried out by office workers. She notes: "the procedural structure of organizational activities is the product of the orderly work of the office, rather than the reflection of some enduring structure that stands behind that work." It is not that office procedures are irrelevant, it is just that these procedures are constituted by a number of activities, often requiring negotiation with co-workers, the result of which can be interpreted as performance according to procedures.

The 'informal' interactions that take place in the office thus not only serve important psychological functions in terms of acting as a human support network for people, for example, providing companionship and emotional support, but are crucial to the actual conduct of the work process itself. Evidence for this is apparent when workers "work-to-rule", i.e., perform exactly as specified by the office procedures, no more and no less. The result is usually that the office grinds to a halt very quickly!

So, what does this imply for the design of office support systems? Building computer systems where work is seen as simply being concerned with "information flow", and neglecting the articulation work needed to make the "flow" possible, can lead to serious problems. Computer-support of cooperative work should aim at supporting self-organization of cooperative ensembles as opposed to disrupting cooperative work by computerizing formal procedures.

In the same vein, Robinson in his paper on "double-level languages" (1989) states that a CSCW application should support at least two interacting "levels of language". In addition to the naked functionality of the CSCW application, the system should have facilities that allow users to freely negotiate task allocation and articulation. That is, the system should provide multiple alternative channels of interaction. As an example of a system providing a simple, yet effective, alternative channel for cooperative task articulation, Robinson cites the GROVE system developed by MCC (Austin, Texas) in 1988. Basically, GROVE is a multi-user outline processor, allowing multiple users to cooperate on drafting a common text. In addition to the interactions visible through the ongoing online textual modifications, the users could talk to each other about what was going on, and why, by means of a voice link. In the terminology suggested by Robinson, the voice link provided "the second level of language". Robinson's insightful remarks are worth quoting here:

"It can be said that any non-trivial collective activity requires effective communication that allows both ambiguity and clarity. These ideas of ambiguity and clarity can be developed as the 'formal' and 'cultural' aspects of language as used by participants in projects and organizations. 'Computer support' is valuable insofar as it facilitates the separation and interaction between the 'formal' and the 'cultural'. Applications and restrictions that support one level at the expense of the other tend to fail. The formal level is essential as it provides a common

reference point for participants. A sort of 'external world' that can be pointed at, and whose behavior is rule-governed and predictable. The cultural level is a different type of world. It is an interweaving of subjectivities in which the possible and the counterfactual are as significant as the 'given'. The formal level is meaningless without interpretation, and the cultural level is vacuous without being grounded."

We can utilize this distinction when we analyze other CSCW applications. Take, for example, the Co-ordinator mail system developed by Flores and Winograd (Winograd, 1986). In his analysis of this system, Robinson (1989) notes how some reviewers have criticized the system because it forces people to be explicit about their commitments in their messages. But, he comments, and we concur:

"There is no objection to making 'explicit and textual' a dimension of communication. Indeed, in general, such separations of 'formal' and 'cultural' levels are seen as creative and desirable. The Co-ordinator falls down, not because it has a formalised ('textual') dimension, but because it has excluded, marginalised, and even illegitimised the 'cultural' dimension of conversation. Unless these two levels interact, fruitful co-operation will not happen."

Or, take the early CSCW project management support tool XCP (Sluizer and Cashman, 1984). In the words of its designers,

"XCP is an experimental coordinator tool which assists an organization in implementing and maintaining its procedures. Its goal is to reduce the costs of communicating, coordinating and deciding by carrying out formal plans of cooperative activity in partnership with its users. It tracks, prods, and manages the relational complexity as captured in the formal plan, so that human resources are available for more productive tasks. [...] An important effect is that XCP encourages an organization to clearly define formal procedural obligations and relationships."

It would appear that XCP assumes that what people do in many work settings is to follow procedures. No wonder the authors note the difficulty involved in developing and "debugging" the formal protocol. The generalization of such an approach to a wide range of office situations seems unrealistic. It too appears to exclude the "cultural" dimension of task articulation.

3.2. Sharing an Information Space

How to support a shared information space is one of the core problems for the CSCW field. This issue predates computer technology; it is fundamental to cooperative work, although the problems are aggravated by the increased scope and intensity of cooperative work relations facilitated by computer systems. As observed above, cooperative work may be conducted in a distributed and indirect way, and because of that, computer systems meant to support cooperative work must support retrieval of information filed by other workers, perhaps unknown, in another work context, perhaps also unknown. In addition to that, even work conducted collectively and directly may require the interaction of people with multiple goals of different scope and nature as well as different heuristics, conceptual frameworks, etc. This gives rise to a series of problems, quite apart from the technical problems of concurrency control etc. in multi-user applications (cf., e.g., Greif and Sarin, 1987; Stefik et al. 1987). We give a brief account of some of these problems below.

First, people prefer different problem solving strategies or heuristics. Accordingly, decisions bear the stamp of the strategy applied in reaching the decision. They are the result of biased reasoning. In cooperative decision making, then, which we regard as the norm in even supposedly 'routine' office work, people discount for the biases of their colleagues. This point was brought home very eloquently by Cyert and March in their classic study (1963):

"For the bulk of our subjects in both experiments, the idea that estimates communicated from other individuals should be taken at face value (or that their own estimates would be so taken) was not really viewed as reasonable. For every bias, there was a bias discount."

Thus cooperative decision making involves a continuous process of assessing the validity of the information produced by colleagues. In cooperative work settings involving discretionary decision making, the exercise of mutual critique of the decisions arrived at by colleagues is mandatory for all participants. In order to be able to assess information generated by discretionary decision making, each participant must be able to access the identity of the originator of a given unit of information. That is, a shared information space must be *transparent*. Problems of information-ownership and the responsibility for its upkeep and dissemination to others, have been neglected in much of the information systems literature, though the work of Nurminen and his colleagues on Human-Scale Information Systems partly addresses this important issue (see Hellman, 1989, for some information on this framework).

Second, decisions are always generated within a specific conceptual framework, as answers to specific questions. Thus knowledge of the perspective applied by the person in reaching a decision and producing information is indispensable to colleagues supposed to act intelligently on information conveyed to them. Accordingly, in addition to the task-related information being conveyed (the message itself, so to speak), a shared information space must provide contextual knowledge of the conceptual frame of reference of the originator. Thus, a computer-based system supporting cooperative work involving decision making should enhance the ability of cooperating workers to interrelate their partial and parochial domain knowledge and facilitate the expression and communication of alternative perspectives on a given problem. This requires a representation of the problem domain as a whole as well as a representation, in some form, of the mappings between perspectives on that problem domain. Again, we are not very far along in understanding how to build in such properties into our systems, despite the converging evidence that these kinds of supports are required by people. To summarize, then, data-bases for cooperative decision making must be transparent in terms of the identity of the originator of information and the strategies and perspectives applied in producing the information.

Yet a third problem, albeit one that has had some public discussion, has been the presupposition among many designers of information systems that information is something innocent and neutral. This view implied that to design an information system for a company one needed only to consider the data flows and files existing in that company. Consequently, a common data base containing all the relevant data from different parts of the organization, providing managers with a unified data model of the organization, was believed to be attainable. In the words of Ciborra (1985), hard reality has condemned this idea to the reign of utopia. In fact, the conventional notion of organizations as being monolithic entities is quite naive. Organizations are not perfectly collaborative systems. Rather, the perspective on organizations that views them as a mixture of collaboration and conflict, overt and covert, appears to be more illuminating and have greater explanatory potential than the traditional 'rationalistic' account. We view organizations as a coalition of individuals motivated by individual interests and aspirations and pursuing individual goals (Cyert and March, 1963). Accordingly, in organizational settings information is used daily for misrepresentation purposes. Most of the information generated and processed in organizations is subject to misrepresentation because it

has been generated, gathered and communicated in a context of goal incongruence and discord of interests and motives.

On the one hand, the requirement of transparency is amplified by this divergence. That is, knowledge of the identity of the originator and the situational context motivating the production and dissemination of the information is required so as to enable any user of the information to interpret the likely motives of the originator. On the other hand, however, the requirement of transparency is moderated by the divergence of interests and motives. A certain degree of opaqueness is required for discretionary decision making to be conducted in an environment charged with colliding interests. Hence, *transparency must be bounded*. The idea of a comprehensive, fully transparent database is not realistic. A worker engaged in cooperative decision making must be able to control the dissemination of information pertaining to his or her work: what is to be revealed, when, to whom, in which form?

These realities of organizational life must be investigated seriously if CSCW is to be turned from a fascinating laboratory research activity into an activity producing useful real world systems. By flatly ignoring the diversity and discord of the 'goals' of the participants involved, the differentiation of strategies, and the incongruence of the conceptual frames of reference within a cooperating ensemble, the proponents of the prevailing 'group work' oriented approach to CSCW evade the problems of a shared information space. Instead, they tend to focus on the technical problems of multi-user systems, that is, they also can be viewed as ultimately accepting a technology-oriented approach to the problem, with its concomitant limitations.

3.3. Designing Socio-technical Systems

The issue of changes in organizational life caused by technological developments has a long history. By changing the allocation of functions between humans and their implements, changes in technology induce changes in the work organization. Roberts' "self-acting mule" (1830), for instance, performed the functions of directly controlling the spinning operations. Because of that, the skilled spinners could be removed from cotton manufacturing and be replaced by semi-skilled operators. The "self-acting mule" induced the transition to the work organization of the modern factory.

Because of its flexibility, the computer is an agent of organizational change *par excellence* and, hence, designing computer-based systems for cooperative work settings is like writing in water. By careful analysis and design, the information system may be designed to match the current social structure of the labor processes. But this change of technology, in turn, induces a change of the social structure of the labor processes. This has been the bitter experience of a plethora of office automation projects and installations, designed to match the traditional allocation of tasks in the office. The Office Automation experience has unequivocally demonstrated that the potentials in terms of productivity, flexibility, product quality, etc. of information technology in the office cannot be realized without a corresponding change in the allocation of tasks among staff. (Hammer, 1984; Skousen, 1986; Hedberg et al., 1987; Schmidt, 1987).

To an extent, any software application project involves the design not just of a technical subsystem, but it also embodies - implicitly if not explicitly - assumptions about how this system will be used within organizations. The system is an

organizational change agent. That is, knowingly or unknowingly, the designer does not merely design a computer system. What is being designed is a work organization. Some researchers and designers acknowledge this. For instance, Winograd (1986) notes:

"Every time a computer-based system is built and introduced into a work setting, the work is redesigned - either consciously or unconsciously. We cannot choose to have no impact, just as we cannot choose to be outside of a perspective. We can make conscious choices as to which ones to follow and what consequences we anticipate."

When we are addressing the task of designing computer-based systems to support cooperative work, however, we need to understand and control far better the interaction between technique and work organization than has heretofore been the case (see also Bødker et al., 1988). The old problems of fitting technology into the workplace have become acute for CSCW:

First, when we move from narrow domains and start to discuss computer support for the coordination and control of a large portion of everyday workplace activities, the assumptions about the use situation surface as more and more important variables. An adequate understanding of what is really going on in the workplace (see sections 3.1 and 3.2) becomes crucial to acceptance and use of these systems.

Second, if we are to design really usable systems to support cooperative work we need to develop a theoretical framework that will help us understand the complex interactions between the technical subsystem, the work organization, and the requirements of the task environment. To design CSCW systems designers must analyze the target organizations in order to come up with answers to such questions as: What are the reasons for this particular task allocation? Can it be attributed to customary privileges or prejudices? Is it imposed by labor market agreements? Is it required by law? Or is it required by the customer, e.g., to ensure specific quality requirements? Can it be attributed to the technical resources at hand in the given case. Can it be attributed to the available facilities for information retrieval or communication, for instance? And so forth. In short, can and should the current task allocation be changed by design?

Thus, we believe that designers of CSCW applications must be able to distinguish analytically the multitude of forms of social interaction that play a part in shaping work organizations in any real world work setting, for example:

- The forms of interaction in the labor process itself as determined by the natural and technical resources available.
- The organizational setting of the interaction.
- The customary privileges and prejudices of task allocation.
- Institutional forms of expressing and regulating conflicts of interest, etc.
- The forms of social control in the work place.
- The forms of allocation of power and authority.
- The impact of the function of the enterprise in the socio-economic system at large.
- The impact of the structure and state of the labor market.

And so forth.

The required theoretical framework that would help analysts and designers to deal with these issues, however, is not imminent (see Schmidt, 1988, for an initial assault on the problem). As pointed out by Howard (1988) the CSCW field is in short supply of detailed studies on the effects of current generation CSCW systems

on the nature of work processes. Thus, we need to perform more detailed empirical studies, as well as design incremental modifications to existing systems and observe their effects.

4. Conclusion

In his plenary address to CSCW '88, the psychologist Don Norman gave a number of examples of the primitive level of present-day interfaces to computer systems. This was in the context of the individual computer user. Without wishing to be defeatist, Norman then amusingly noted the lack of knowledge that existed currently with respect to group processes and cooperative cognition, and cautioned against excessive optimism in designing successful computer systems to support cooperative working. His admonishments are worth noting. At the same time, applications are being developed for cooperative work settings and products are being shipped. Without a resolution to, or, at least, an attempt to come to grips with, the kinds of problems inherent in designing for CSCW applications identified in this paper, the likelihood for success is minimal. The challenge to designers in the field is large, as we still have not done enough to evaluate the impact of our early systems in this area. Thus there is ample work for both the implementers and the social scientists concerned with these issues!

5. References

- Elihu M. Gerson and Susan Leigh Star (1986): "Analyzing Due Process in the Workplace," *ACM Transactions on Office Information Systems*, vol. 4, no. 3, July 1986, pp. 257-270.
- Hans Paul Bahrdt (1958): *Industriebürokratie. Versuch einer Soziologie des Industrialisierten Bürobetriebes und seiner Angestellten*, Ferdinand Enke Verlag, Stuttgart.
- Hans Paul Bahrdt (1984): *Schlüsselbegriffe der Soziologie*, Verlag C.H. Beck, München.
- Liam Bannon, N. Bjørn-Andersen, and B. Due-Thomsen (1988): "Computer Support for Cooperative Work: An appraisal and critique," in H. J. Bullinger et al. (eds.): *EURINFO '88. Information Systems for Organizational Effectiveness*, North-Holland, Amsterdam, 1988.
- Susanne Bødker, P. Ehn, J. Knudsen, M. Kyng, and K. Madsen (1988): "Computer Support for Cooperative Design", *CSCW '88. Proceedings of the Conference on Computer-Supported Cooperative Work, September 26-28, 1988, Portland, Oregon*, ACM, New York, NY, 1988, pp. 377-394.
- Claudio U. Ciborra (1985): "Reframing the Role of Computers in Organizations: The Transaction Costs Approach," *Proceedings of Sixth International Conference on Information Systems, Indianapolis, December 16-18, 1985*.
- Richard M. Cyert and James G. March (1963): *A Behavioral Theory of the Firm*, Prentice-Hall, Englewood Cliffs, N.J.
- Ralf Dahrendorf (1959): *Sozialstruktur des Betriebes*, Gabler, Wiesbaden.
- Pelle Ehn (1988): Remarks in panel discussion on "CSCW: What does it mean?", *CSCW '88. Proceedings of the Conference on Computer-Supported Cooperative Work, September 26-28, 1988, Portland, Oregon*, ACM, New York, NY, 1988.
- Irene Greif and Sunil Sarin (1987): "Data Sharing in Group Work", *ACM Transactions on Office Information Systems*, vol. 5, no. 2, April 1987, pp. 187-211.
- Irene Greif (ed.) (1988a): *Computer-Supported Cooperative Work: A Book of Readings*, Morgan Kaufman, San Mateo, California.
- Irene Greif (1988b): Remarks in panel discussion on "CSCW: What does it mean?", *CSCW '88. Proceedings of the Conference on Computer-Supported Cooperative Work, September 26-28, 1988, Portland, Oregon*, ACM, New York, NY, 1988.

- Jonathan Grudin (1988): "Why CSCW Applications Fail: Problems in the Design and Evaluation of Organizational Interfaces", *CSCW '88. Proceedings of the Conference on Computer-Supported Cooperative Work, September 26-28, 1988, Portland, Oregon*, ACM, New York, NY, 1988, pp. 85-93.
- Michael Hammer (1984): "The OA Mirage," *Datamation*, vol. 30, no. 2, February 1984, pp. 36-46.
- Bo Hedberg et al. (1987): *Kejsarens nya kontor. Fallstudier om datoranvändning*, Liber, Malmö, Sweden.
- Ritta Hellman (1989): "The Human-Scale IS Approach - An Operationalization", in H. Klein and K. Kumar (eds.): *Systems Development for Human Progress*, North-Holland, Amsterdam, 1989, pp. 225-240.
- Robert Howard (1987): "Systems Design and Social Responsibility: The Political Implications of 'Computer-Supported Cooperative Work': A Commentary", *Office: Technology and People*, vol. 3, no. 2, 1987.
- Robert Howard (1988): Remarks in panel discussion on "CSCW: What does it mean?", *CSCW '88. Proceedings of the Conference on Computer-Supported Cooperative Work, September 26-28, 1988, Portland, Oregon*, ACM, New York, NY, 1988.
- Robert Johansen (1988): *Groupware. Computer Support for Business Teams*, The Free Press, New York and London, 1988.
- Horst Kern and Michael Schumann (1970): *Industriearbeit und Arbeiterbewusstsein. Eine empirische Untersuchung über den Einfluß der aktuellen technischen Entwicklung auf die industrielle Arbeit und das Arbeiterbewußtsein*, vol. I-II, Frankfurt am Main.
- Rob Kling (1988): Remarks in panel discussion on "CSCW: What does it mean?", *CSCW '88. Proceedings of the Conference on Computer-Supported Cooperative Work, September 26-28, 1988, Portland, Oregon*, ACM, New York, NY, 1988.
- Morten Kyng (1988): "Designing for a Dollar a Day", *CSCW '88. Proceedings of the Conference on Computer-Supported Cooperative Work, September 26-28, 1988, Portland, Oregon*, ACM, New York, NY, 1988, pp. 178-188.
- K. Lyytinen and Rudy Hirschheim (1987): "Information System Failures: A Survey and Classification of Empirical Literature", *Oxford Surveys in Information Technology*, vol. 4, 1987, pp. 257-309.
- Karl Marx (1867): *Das Kapital. Kritik der politischen Ökonomie*, vol. 1; MEGA, vol. II/5.
- Otfried Mickler et al. (1976): *Technik, Arbeitsorganisation und Arbeit. Eine empirische Untersuchung in der automatischen Produktion*, Aspekte Verlag, Frankfurt am Main.
- Delbert C. Miller and William H. Form (1964): *Industrial Sociology. The Sociology of Work Organizations*, 2nd ed., Harper & Row, New York etc.
- Heinrich Popitz, H. P. Bahrdt, E. A. Jüres, and H. Kesting (1957): *Technik und Industriearbeit. Soziologische Untersuchungen in der Hüttenindustrie*, J. C. B. Mohr, Tübingen.
- Mike Robinson (1989): "Double Level Languages and Co-operative Working", *Support, Society and Culture. Mutual uses of Cybernetics and Science. Proceedings. Conference. March 27-April 1, 1989, Amsterdam*, pp. 79-114.
- Jean-Paul Sartre (1960): *Critique de la raison dialectique*, vol. I, Gallimard, Paris.
- Kjeld Schmidt (1987): *Kontorautomation - realitet eller reklame?*, Kommuneinformation, Copenhagen.
- Kjeld Schmidt (1988): "Cooperative Work: A Conceptual Framework", Position paper for workshop on "New Technology, Distributed Decision Making and Responsibility," Bad Homburg, May 1988. [Revised edition in Rasmussen, Leplat, and Brehmer (eds.): *Modelling Distributed Decision Making*, Wiley (forthcoming)].
- Beau Sheil (1983): "Coping with Complexity", *Office: Technology and People*, vol. 1, 1983
- Thomas Skousen (1986): *Kontorautomatisering og medarbejderindflydelse. 3 succeshistorier fra erhvervsliv og offentlig sektor*, Samfundslitteratur, Copenhagen.
- S. Sluizer and P. Cashman (1984): "XCP. An Experimental Tool for Supporting Office Procedures", *Proceedings. First International Conference on Office Automation*, IEEE-CS Press, December 1984, pp. 73-80.
- Mark Stefik, G. Foster, D. Bobrow, K. Kahn, S. Lanning, L. Suchman (1987): "Beyond the Chalkboard: Computer support for collaboration and problem solving in meetings", *Communications of the ACM*, vol. 30, no. 1, pp. 32-47, January 1987.

- Anselm Strauss (1985): "Work and the Division of Labor," *The Sociological Quarterly*, vol. 26, no. 1, 1985, pp. 1-19.
- Lucy Suchman (1983): "Office procedures as practical action", *ACM Transactions on Office Information Systems*, vol. 1, 1983, pp. 320-328.
- Sørgaard, P. (1987) "A cooperative work perspective on use and development of computer artifacts", paper presented at 10th Information Systems Research Seminar in Scandinavia (IRIS) Conference, Vaskivesi, Finland, 1987. [DAIMI PB-234, Computer Science Dept., Aarhus University, DK-8000 Denmark].
- James D. Thompson (1967): *Organizations in action. Social science bases of administrative theory*, Mc Graw-Hill, New York, etc.
- Andrew Ure (1835): *The Philosophy of Manufactures*, London.
- Edward Wakefield (1849): *A view of the art of colonization...*, London.
- Richard Whitley (1974): "Cognitive and social institutionalization of scientific specialties and research areas," in Whitley (ed.): *Social Processes of Scientific Development*, Routledge and Kegan Paul, London, 1974, pp. 69-95.
- Terry Winograd (1986): "A language/action perspective on the design of cooperative work", *CSCW '86. Proceedings. Conference on Computer-Supported Cooperative Work. December 3-5, 1986. Austin, Texas*, ACM, 1986, pp. 203-220.
- Eleanor Wynn (1979): *Office conversation as an information medium*, Unpublished Ph.D. dissertation, University of California, Berkeley, CA, 1979.