Community Technology?
Issues in Computer - Supported Work (1)

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1. Introduction

In this paper I wish to discuss a number of issues concerning work practices, especially communication and cooperation among people, and examine how we can use the computer as a tool and/or medium for supporting such group activities. The intent is not to substitute computer-mediated for face-to-face or other forms of communication, but rather to discover if there are *additional* possibilities that may be afforded us through use of computing technology. My emphasis is not with the *technology* per se, but with people, their needs and activities. My focus is on how we can augment human capabilities through use of the technology, rather than on how to simulate or replace labour processes with machines. I believe, along with Rosenbrock (1981) and many others, that our present-day utilization of information technology in work has tended to restrict, rather than expand human potential. This is not due solely to the nature of the technology itself, although it is not a neutral element (see Winner, 1980) but also to the organization of work around the technology (see Boddy & Buchanan, 1982), and the general socio-economic and political rationale within our society which develops these machines and industrial systems (see Noble, 1980, 1985).

The paper does not present a carefully compiled rationale for an alternative technology, or an argument for the construction of new "widgets", but consists of a number of observations, reviews of research, experiences with current technologies, and speculations about possible future uses of technology in promoting communication between people. The intent is to sharpen our understanding of everyday activities, and open up alternative paths for future design of support technology. Reaction in the form of supportive or negative examples of technology use in group settings is particularly welcome from readers.

2. Working in Organizations: Social Practices

2.1 Office Work

Let me begin with a brief account of the changing conceptions of office work and the technology to support it. The commonly accepted view of what constitutes an office still relies heavily on the traditional bureaucratic model - a group of 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 . (A similar comment could be made about the early "management information systems" (MIS) developed to assist decision-makers in organizations.)

Such systems have now been admitted as failures (Lyttinen & Hirschheim, 1987). Researchers and practitioners are beginning to appreciate the inherent complexity of supposedly "routine" tasks and the difficulty of capturing the the tacit knowledge and "day-to-day" informal practices of office workers . More recent studies, performed by anthropologists and sociologists employing an ethnomethodological approach (a sociological approach that puts emphasis on the "work" performed by people which produces the social order that usually forms the object of study for the researcher) have emphasized the rich nature of many routine activities in the office and the complex pattern of decision-making engaged in by co-workers, even at relatively "low" positions within the organization, based on informal conversations and negotiations (Wynn, 1979, Suchman, 1983, Gerson & 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 other co-workers, the result of which can be interpreted as performance according to procedures (Wynn, 1979, Suchman, 1983, Gerson & Star, 1986).

Wynn(1979) notes "In an office as it presently operates, the knowledge which is both means and product is dependent on interaction between people for its quality, relevance and appropriateness. These interactions are in turn dependent on social practices" (Wynn, 1979, pg. 165). Gerson and Star (1986) refer to this *articulation work* necessary in reconciling differing viewpoints, local contingencies, and multiple interests that is a part - and - parcel of "routine" office work. This articulation allows for "local closure" that temporarily closes the open information system and allows the

job to get done, this time around, but not necessarily forever. It is a local "workaround" or kludge, yet an essential one. 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", ie. 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. Gerson and Star (1986) identify a number of key issues, that need to be addressed in the design of *office support* systems. (Note that the change in language to talking about office support rather than the more limited idea of *office automation* is a positive step. Rather than trying to automate procedures, system designers are beginning to realise that their task is to support office workers in getting the job done, rather than trying to incorporate the articulation work itself into the system - an impossible task.) These include the ability to represent multiple viewpoints, the fundamental incompleteness of representations, the complexity of apparently simple pieces of information, the historicity of work practices and procedures, the inability to predict system requirements a priori - necessitating *on-going design in use*, and the need for empirical knowledge of the actual workplace. Attempting to build systems responsive to these issues should keep designers busy indefinitely!

In sum, rather than trying to reduce the "inefficiencies" introduced by informal communications between staff members, from the viewpoint of the classical theory of the firm, we should encourage an environment where workers have opportunities for cooperating and sharing this information which is essential to office work. Recognition of the importance of informal interactions at all levels in the organization, and the importance of building a "sense of community" among co-workers has increased recently and the issues this raises are discussed in the next section.

2.2 Encouraging Interaction and Building A "Community" in Organizations

Current views on organizations and working life stress the importance of working together in teams and groups, and sharing information among group members. The need for intergroup contact and discussion has also been recognized. These accounts usually refer to the turbulent nature of the outside environment and the need for increased "awareness" throughout the organization of impending change. Office planners, environmental psychologists, organization theorists and others have been paying attention to the need for providing opportunities for people to mingle, and meet each other in informal ways to allow for exchange of information. This is due to an increasing realization that *serendipitous contacts* between people, and informal pickup of information, even "gossip"(!), can improve organizational effectiveness through shared visions, culture, and awareness of other people's interests and activities (see March & Sevon, 1984, Peters & Waterman, 1982). The importance of the coffee machine as a focal point for useful informal contacts has often been described (see Weinberg, 1981 for a classic account). Becker (1988) describes Steelcase Corporation's new headquarters

building, which was designed explicitly to take into account changing work activities and new technologies. He notes: "The lobby, cafeteria, and several break areas are viewed as "activity generators" intended to support serendipitous face-to-face contact.....the lobby will have a coffee cart...and seating arranged to encourage employees to pause and talk for a few minutes with others they might not otherwise run into.... On escalators and stairs, he notes, "the anonymity of elevators and stairs behind walls have been replaced with escalators and broad and visible stairs. This increases the opportunity for establishing visual contact with other people...". Becker is not unaware that successful use of the innovations will depend on changes in organizational culture, eg. the acceptance of spending time in coffee areas as being a legitimate activity. It will be interesting to see how the experiment turns out. (One important issue not explicitly mentioned by Becker in his paper is whether the office workers themselves were involved, and to what extent, in the design of these new facilities.)

Such physical office landscaping may improve the possibilities for picking up useful information, but it does not address the needs of a particular group for problem-specific information on working practices. Everyone knows about the need for "on-the-job" training in order to make new workers effective within the group. Familiarity with office procedure manuals does not help new workers when it comes to the articulation work described earlier. This local context has to be imparted *on-the-job*. The willingness of members of the group to share their working knowledge with others will depend on how they perceive the outcome of such an act. In some cases the local knowledge and experience will be witheld in order to increase the power of the owner of the information. In other group settings, with strong bonding between fellow workers, the imparting of this information can be seen to be a necessary part of this bonding process, implying a trust among co-workers, and helping the new member to feel a part of the community.

[*Note*:We must be careful here when we talk about building a "community" among groups of workers. People do not form a community simply by working together, and communicating, or being physically proximate, they must *share common goals*. Depending on one's perspective, the work group that includes the manager of the group would not, for some, constitute a "community" in the sense one might wish to use the term. If people do not share goals then any form of information pooling or sharing of information becomes a sensitive socio-political act, not simply a rational systems act. For instance, when system developers discuss building a common database for several groups in an organization, they sometimes only see the technical aspects of the problem. But it is essential to realise that the information is owned by different individuals, groups or departments, and that access and use of it implies entering into commitments with various parties. Such common databases also often require differing levels of committment from different groups in order to maintain them. Who would benefit from the construction and maintenance of such a resource, and who would lose? (See Grudin, 1988, for more on this issue). These questions can be posed to the individuals who make up the group, in an effort to determine the likelihood of them adding to the common knowledge base, and to the group as a whole, or even the organization. At the topmost level, the firm could be seen to benefit from any attempt to codify and extract the workers knowledge, which then could be used to put more pressure on the workforce, or reduce the need for certain skilled labour. Within this perspective, any attempt to collect and systematize worker knowledge and skills -for

the benefit of management- should be resisted. Must we therefore dispense with the idea altogether, or can we set up conditions for the development and use of a common information utility that would overcome these particular objections? Does it even make sense to think of "abstracting" this contextual information and "preserving" it, as this implies a static view of knowledge and "know-how" that ignores the processual aspects of knowledge elicitation and use? These are questions that must be answered for each setting and each application individually, but we will discuss this latter issue briefly in Section 4.1]

3. The Computer as a Medium for Interpersonal Communication

3.1 Some Background

Having looked at work practices in the previous section, let us now turn to developments in the computing field that might have an impact on such aspects of work as communication, informal interaction, and social support. As we have seen, much human activity in social and work settings involves interaction with others. These activities can be cooperative or competitive, two-person or many person, and can have a variety of constraints surrounding them concerning the formality of the interaction, the power relationships involved, etc. However, a fundamental prerequisite for any joint activity is the ability to communicate. It has been noted that communication is a form of mediated activity that is indirect, incomplete, selective, and creative . This is true of communication in any form, using any medium, although the nature of the selectivity will vary dependent on the particular medium. Yet, paradoxically, the word communication stems from the Latin term meaning "to put in common", so the study of any communication medium should involve analyses of how each medium achieves this "putting in common" despite its inherent biases.

The idea of the computer as a medium for interpersonal communication is not a novel one, although it has usually been overshadowed by the "computer as calculator" perspective. Note that I am refering to the use of *the computer as a medium for people to communicate through*, and not simply to computer-computer connections here. (I discuss this aspect of computer-mediated communication at greater length elsewhere, Bannon, 1986b). At the first international conference on computer communication, Conrath (1972) noted the paucity of attention paid to the role of the computer as an intercessor in inter-human communication. Even earlier, there appeared a prescient article entitled "The Computer as a Communication Device" by Licklider, Taylor, and Herbert (1968). Although the article paints with a broad, and overly technocentric brush, it does contain several insights as to the possible future role of computers as communication devices for people. They saw the computer not only as a repository of information, or a simple conduit for "information", but as a medium that could be used to dynamically transform this information, and to help people to share their view of the world with others through joint manipulation of each person's personal models of the situation.

This emphasis on the need to share models, in order to be able to communicate, is echoed in the work of Thompson (1972, 1984). He has put forward the concept of an increase in the shared information space of the communicating parties as a key feature of radical innovations in communications technology. In his view, the move from

speech to writing, to print, effected three significant changes in the surrounding culture - a change in the ease with which stored human experience can be accessed, an increase in the size of the common information space shared by the communicants, and an increase in the ease with which new ideas can be propagated throughout society. As these features are difficult to measure directly, he proposes a "test of significance" for each as follows:

1) Must affect the way in which people index information

2) Must increase the range of strategies open to the communicants for the interrupt act.

3) Must increase the probability of transmitting or receiving an interesting but unexpected message.

Thompson (1984) shows how the concept of shared space is important from examples of how echo suppressors, loudspeaking telephones and satellite links can upset the normal *shared acoustic space* of telephone communication in subtle ways. For example, traditional echo suppressors effectively turn a full-duplex, truly shared medium into a half-duplex, one-way means of communication. When one person talks and the other cannot interrupt, thus indicating that the acoustic space is not shared. Failure to realise the technological basis for this distortion has resulted in severe social complications when attempting to use the medium for personal communication, as some of you may have experienced to your cost! If we turn our attention to computer communication, we find that most of the available facilities do not provide a very rich shared information space - especially if one focuses on "real-time" facilities, although one can view even a simple shared file system as providing one primitive level of such a shared information space. Here, an interruption would consist of another user commenting on some information put in the common file system by another user. An outline of some synchronous facilities that support a richer "real-time" shared space is described in Bannon (1986b).

The concept of the computer as a communication device was reinforced by the development of computer communication networks, especially the ARPANET in the US (See Quarterman & Hoskins, 1986, for a survey of this field). The ARPANET computer network was established in the late 60's as a research tool for the Advanced Research Projects Agency of the Department of Defense, utilising a novel packet-switching technology. Universities and industrial research centers involved in ARPA contracts throughout the U.S. were connected by this system (there were also connections to the UK, Norway and Hawaii). This pioneering system has been used in a variety of ways - for allowing access to facilities at remote sites, for file transfer between sites, for public mailboxes that everyone can read ("bulletin boards") and for simple electronic mail exchanges between individuals and memo groups at different sites. Of interest here is that the electronic mail function was one which was not given much attention in the initial design of the net, yet it became one of the most valued services provided on the network. The convenience of being able to send a message to someone across the country, without having to worry about the time discrepancy or distance involved, and receive an answer within a few hours was inestimable and has

had a significant effect on the growth of "electronic communities" that will be discussed later.

One of the few people who foresaw the revolutionary potential of the computer as a medium for improving idea development and group communication was Doug Engelbart, who conceived a project entitled "Augmenting the Human Intellect" at Stanford Research Institute in the early sixties (Engelbart, 1963). He wanted to build a new kind of computerized working environment in which the emphasis was on how people could achieve significant gains in productivity as a result of the computerized support made available to them. Integral to Engelbart's scheme was the provision of computerized support to enhance communication between people. As well as providing electronic mail facilities on his system, users could link their screens together and thus work in a shared space mode, often with a telephone connection as well, so people could discuss and change the joint document they were viewing. With regard to the community memory idea raised earlier, the system provided a Journal facility for archiving messages and reports to serve this function. Items in this record could be directly refenced in messages, and the receiver could get access directly to the referenced document if required. Given the time period, some of the ideas and implementations were quite far-sighted, and only recently have other researchers begun to re-investigate this work in the context of the newly emerging field that has been labelled CSCW - Computer Supported Cooperative Work.

3.2 Communication or Collaboration Support?

Two trends can be noted in work on computer-mediated communication (CMC) and computer - supported cooperative work (CSCW). (See Greif, 1988, for a collection of papers in this area). One tends to focus on the *capabilities of the technology* and shows how certain features, for example computer conferencing, affect group communication patterns (Hiltz, 1984, Freeman,1980). Another focuses on *actual work situations*, and attempts to show how work might be accomplished more effectively through use of the new media. The latter does not focus on the effects of the medium per se, but on what aspects of the medium might be utilised to produce more effective tools for collaboration and coordination. Here the focus is not simply on establishing a communication link between people, but on augmenting the possibilities for interaction by using the computer to help coordinate activities and support joint problem-solving, by providing shared workspaces and tools for annotating and writing documents. In this context, even as simple a facility as the personal electronic calendar that is selectively accessible to others can be an important CSCW tool to assist in the coordination process.

The topic of CSCW, its definition and meaning, has been the subject of much recent discussion which I will not go into here. (See Robinson, this Conference, Bannon et al, 1987, Sørgaard, 1987, and Greif, 1988 for further information). Rather I will briefly mention a few examples of how computers might assist in supporting information sharing between workers, and some issues involved (See Bannon 1986a,1986b for further details and examples).

3.3 Asynchronous Computer -Mediated Communication: Electronic Mail, Bulletin Boards, Computer Conferences

I have been interested in how we might be able to provide on networked computers some facilities that might increase the possibility of discovering serendipitous information or meeting people with similar interests at low cost. Feldman (1986) has discussed how "weak ties" can be formed through electronic mail distribution lists among workers in physically separate areas of an organization. If the organization has bulletin boards, or a conferencing system, people can join activities of interest, as well as partake of quite loosely structured conferences that allow for this serendipitous pickup of information - "coffee-shop" electronic meetings! Of course a problem with many open-ended possibilities for communication is that the user can be overwhelmed with information - the "information-overload" problem. Although there have been several attempts to solve, or reduce this problem (Hiltz & Turoff, 1985, Malone et al., 1987), they are not entirely satisfactory. For example, the Information Lens depends on the user's ability to construct rules to automatically handle incoming messages and sort appropriately. Our use of a version of this system shows that it is difficult to come up with general rules due to the context-sensitivity of our actions (This just reinforces the points made by Gerson and Star about local contigencies, etc in Section 2). It is hard to specify in advance a rule of sufficient power and generality to be really useful! Another alternative is to use people acting as human filters of information. Borenstein and Thyberg (1988) give a nice example of the use of human filters in the Andrew Message System at Carnegie-Mellon University. These human filters select articles from a number of bulletin boards for inclusion in their edited "magazine" on a particular topic, and send this out on the net. Presuming the interests of the editor and reader are similar, the user is spared much tedium scanning all the original bulletin boards, yet still receives additional information that may be of interest, relative to other means of communication. The search for more automatic ways of doing this filtering function will continue, but it is an open question whether we will be able to devise general rules that meet our requirements of sensitivity and coverage adequately.

Let me discuss the use of an electronic network for information dissemination and general discussion that has some interesting properties, one that encompasses a very widely distributed user group, USENET, the worldwide unix computer network. USENET has evolved into an ever growing network linking a rapidly expanding number of sites running Unix. USENET supports mailing lists and bulletin board services concerning an amazingly large variety of work and social activities. Of particular interest is the requests for information or help that can be sent out on the network, and the responses generated. Of course, some of the quick, and detailed responses that are characteristic of this medium can be explained by the novelty of the electronic medium, but this certainly will not suffice, as it has been in existence now for a number of years, and the phenomenon of quick and detailed responses to help requests is still apparent. Part of its appeal is that members believe themselves to belong to a *community* of fellow-travellers, -mainly software engineers and computer scientists, but basically open to all who seem willing to join in use of the medium, and respect some basic etiquettte - which is often honoured in the breach. An example of an extremely important, for some indispensible, means of support is evident in the unix-wizards group where system programmers ask for and often obtain extremely detailed help from others about the quirks of particular unix implementations. This service is indispensible, as often there is no one in the immediate vicinity of the person that could help with the problem. Being a member of this group gives one access to an incredible wealth of talent and expertise, at no cost either, other than accepting that at a later date, you should be

willing to assist another in a like fashion. Here is a case where a spirit of *mutual support and cooperation* has developed and persisted, even without any central organizational authority or massive face-to-face meetings to encourage compliance with the "rules of the game" - although there are physical meetings of unix user groups and they also serve important roles as information sharing venues and social support networks.

One issue of interest is how might we preserve for the record, for others, some of the ongoing conversations, discussions, items of information that occur in the daily activities of such a network. Of course, we can archive the news, but it rapidly gets to be far too large, and sites usually do not archive for long periods of time. It seems a real waste that much of this help information is not archived in some form, as not only is it often accurate, but we have a definite use setting for it - that is, the information comes from people who have real problems in real situations, and so they differ dramatically from "textbook" exercises. We are learning the importance of local context in understanding what is occurring, in being able to make sense of system behavior. The fact that this record refers to events that have actually happened, and the responses that solve the problem also usually have been tried out and tested under actual operating conditions, gives a higher value to the information that that which normally obtains if it is just information taken from a book or manual, which often has to leave out detail, in order to be more general.

4. Possibilities for the Future

4.1 Community Technology: Shared Knowledge and Memory

We have discussed aspects of office work, and the importance of "talk" in the construction of joint understanding, the development of a collective working memory, and the coordination of action in group settings has been briefly noted (See Middleton, 1988, for an extensive discussion of these topics). Extending beyond work groups to slightly larger communities of people working together, can we develop a role for a community technology that could support these interactions, coordinations, and collective understandings? I have already discussed how the computer may be used as a medium to extend possibilities for collaboration and contact in Section 3.3. Within the context of a local work group, where people have the opportunity to meet face-to-face, the need for electronic support is not so apparent, yet if the facility is there, i.e., people are on a local area network, it seems there are advantages to using it for some shared problem solving and pooling of resources and experiences that might be of benefit to the whole group. I have discussed this more fully elsewhere (Bannon,1986a) in the context of computer users helping each other to learn about the computer system. The basic idea is that *it is the users of the computer system themselves that are the repositories of much relevant information about the system*, about how to accomplish things on the system, about how to even read the manual (not a trivial thing if you have a several hundred page reference manual that is very difficult to skim!) The issue is how can we tap into this *rich social resource* - other people, in ways that are not too disruptive for the individuals, yet that still allow for information to be shared. As well as focused queries to local experts, the role of circulating anecdotes about the system shared by members of the group or community are also worth noting.These "war stories" that are swapped around among various groups, detailing interesting, difficult problems with equipment, and their resolution, not only impart information, they also provide a *context for use* of the information, and they also serve as a way of *bonding* the

group together. They are vehicles for group cohesiveness and identity, and as such cannot be replaced with simple factual information about the original problem that is the basis of the story. (See Orr, 1986, for some discussion of this topic of war stories and their role in organizations).

One possibility might be to try and systematically collect such anecdotal information and preserve it as a repository of shared stories and myths within the community. It could help new members of the group to familiarize themselves with the history of the group, for example. We could perhaps use the computer as a support for retrieval of this information, given the flexibility of the medium for storage of information and the ability to have a number of different kinds of access routes to the information. But does such an approach make sense? Can such stories be put into a *community information or knowledge base* without losing their dual function as both information bearing and social bonding entities? Is the development and use of community knowledge something that can be treated in this way - captured and "frozen" for posterity? (This raises analogies with the "knowledge elicititation" problems in Artificial Intelligence area that I cannot develop here).

What are the pre-conditions for having people commit to contributing and sustaining an information system consisting of stories, anecdotes, as well as useful little programs, observations about the sytem, gossip of various forms? Can the motives be completely altruistic? What are the rewards, both personal, social, organizational, for those that contribute to this information repository, either directly, or when explicitly asked? For example, in one of the research settings that I worked, one of my fellow researchers declined to share with the community his personal data manipulation programs. These would have been of use to others, and there was a precedent in people sharing their programs with others on the system. Since the person concerned was an extremely sociable person, why this reluctance? It turned out that the costs of so doing could be quite high. He had done so in the past, and discovered that other users complained about insufficient documentation, or wanted him to modify the program in various way for their particular needs, commitments that he did not want to fulfill. Ergo, no more public domain programs from him! Another major problem is the updating problem. What happens if the system changes? The author of the program or information may not be around, or be interested in maintaining the program. Unless specific organizational changes are made, and someone made responsible for this updating, it will not happen. It is not uncommon, especially in research environments to have large pieces of out-of-date information and code on the system that can make the whole system seem useless to the newcomer.

What kind of support structures, either embedded in the computer network itself, or external to it, might be of use in a working community to foster cooperative learning and the exchange of information? Are there software needs that can be identified that would assist in the development of such a *community knowledge base*? Although we might be able to capture some local context in the information put on the system, we have omitted the whole issue of how, for example, anecdotes are recounted in specific situations, and this *situated production* is also crucial to the use of such information to help solve actual problems, at least in the case of diagnostic anecdotes, as Orr (1986) notes. So once again the crucial issue may not be simply such stories per se, but their context of use. This raises the question of how much "information" is present in the

text, versus a view of information as something that is jointly constructed by the participants in the actual telling and listening of the story in a specific context. A community knowledge base does not imply a community memory.

[Note: A related idea of recording some form of a project "memory" that would provide a history of development and use of a system (to assist in later maintainability of the system) has recently come into prominence in the context of preserving the rationale for the design of large software systems (eg Conklin, 1989). The idea is to capture as it develops the thinking of designers, the arguments for and against particular design decisions, as well as the actual documents and ongoing exchanges about the project so as to help people at a later time to understand how and why the resulting system works as it does. While this work is still in its early stages, it is interesting to see others pay attention to the process, and not just the product, aspects of design, as documents alone are definitely insufficent to fully understand the resulting system.]

I have been involved in a small project at our department to build a demonstration community information base for users of our Xerox 1186 workstations that might allow us to examine some of the issues I have mentioned above in a particular setting. We entered certain basic information into the system, but have been working on ways to get the users themselves to add to this information base, with information that they themselves have found of use, in practical situations. We tried to reduce the overhead involved in having users add to this information base by providing an interface to the system that made it easy for users to add comments into the system without large overheads in switching contexts and starting up the information utility, by having a small window open on the screen for comments that is automatically saved and incorporated into the information base. We are also concerned about how to reward people for entering useful information, and how to get feedback from other users on the utility of the information provided by users. How to present the updated information is also one of our concerns. It appears that simply waiting for the user to ask for it is not very useful. Sometimes users want answers first, before they know what the question is! (See Owen, 1986 for an exploration of this idea). A problem in our context to date is that we do not have a stable community of users on the system. Some students just use the system for a particular project and then disappear. The sense of belonging to a community is not present to a significant degree, and so the project has been shelved.

4.2. Dynamic Shared Information Spaces

The provision of real-time shared information spaces, as mentioned earlier with respect to Engelbart's work, has recently received more attention. The importance of the blackboard in collaborative design has been noted, and efforts to make an electronic equivalent have begun (See Stefik et al, 1987 for an example). Having a shared material is much more useful than simply talking about something that we cannot directly, jointly manipulate. It provides a common focus for our attention, and also serves as a dynamic record of the work activities. This is of relevance not simply in two person meetings, but also in computerized meetings, where a projected electronic workspace can serve as a common focus for the group. Current research focuses on making the border between stored material and additional gestural markings and annotations more flexible. Note that we can consider use of such a system where participants are either physically co-present or remote. An important aspect of recent work in the

augmentation of human group activities is the realization that the "substitution" model -of computer-mediated for face-to-face meetings - is *not* the key issue. People in real work situations spend a lot of time at meetings, and if much of their work is already computer-mediated, it seems appropriate that they should be able to use this technology in meetings, for recording purposes, to display diagrams, notes, and work on them jointly with others at the meeting. We are still learning about the dynamics of this process, and how to make the computing element less obtrusive, and more "natural" in use (See Mantei, 1988, for a discussion of issues that need to be considered here.)

5. Conclusion

This paper has discussed how computers might be of use in supporting group activities, and some problems with this approach. It is not assumed that the computer medium is required, or beneficial, for all situations. Indeed, the need for "off-the-record" open discussions is a clear case where having any form of on-line record of the group process would be totally inappropriate. At the other extreme, the lack of any record of what transpired at a meeting can cause significant problems in attempting to coordinate actions after a meeting. Perhaps the "ecological niche" metaphor (Bannon, 1986b) is appropriate here. Focusing on the technology per se will not show how the technology should be used. But we can list requirements for certain kinds of group processes, and there are existing technologies that can support these processes. We need to match these needs to the capabilities of the technology (As we Irish say in betting on horse racing, it's a case of "horses for courses"!). Of course, we can also see requirements that are not met by current technological devices, and here is where experimentation with new devices is worthwhile (2). But this still does not imply any necessary link between human activities and technological support. Physical co-presence - without the interference of technologies of any form - will remain the key requirement for the success of many group activities, and this should be recognized. I see the role of computer technology as a possible support (both at the task and interpersonal level) mainly for *already existing* collaborative relationships, rather than as a means for *producing* such relationships. My intent is to expand the ways in which people can communicate and work together, not to force communication along certain paths, using certain tools. (In this connection, note the remarks by Robinson, this Conference, regarding the (mis)use of the Coordinator CSCW tool in some settings).

Notes

1. Some of the material in this paper appeared previously in a technical report by the author // *Extending the Design Boundaries of Human-Computer Interaction*, ICS TR-8505, Institute for Cognitive Science, University of California, San Diego, May, 1985.

2. I realize that the approach mentioned here tends to give a rather static view of the relation between tools and activities. We also need to be aware of how tools change activities, which in turn lead to new requirements for technologies.

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