グループウェア 12−6
（1995. 6. 8）

The History and Future of CSCW and Groupware: A Personal View

Jonathan Grudin
Faculty of Science and Technology, Keio University
3-14-1, Hiyoshi, Kohoku-ku, Yokohama, 223 JAPAN

Information and Computer Science, University of California Irvine
University of California, Irvine
Irvine, California, USA

"Computer-supported cooperative work" and "groupware" are terms invented in the mid-1980's to describe the growing interest in using computer technology to support the activities of groups of people. The interest came from researchers and developers who had previously focused on single-user applications such as compilers, word processors, and spreadsheets; it also came from those who had previously focused on mainframe systems and organizational issues. To understand the work associated with CSCW and groupware in Europe, the United States, and Japan, it is essential to understand the changing nature of systems development from the 1950's through the 1980's. In this presentation I will describe the historical and organizational contexts of CSCW research and groupware development. Who attends the conferences, develops the systems, and identifies with these labels? How and why do their priorities differ? CSCW is often described as an emerging field, but a better metaphor may be a forum or marketplace where people from different places come to browse, shop, and return to their different homes. Communication—understanding each other's work—requires that we understand different histories and cultures.

With the phenomenal success of the Internet and World Wide Web and the very respectable achievements of applications such as Lotus Notes, groupware and support for workgroups is changing the face of work. I will conclude by describing a central challenge brought about by these new technologies and the new way we are looking at and using computer and communication technologies.

This paper includes original material and work explored in depth in [1-4].

1 Introduction: The CSCW Forum

The basic idea that emerges from a study of the history of the activity that has been called computer-supported cooperative work (CSCW), as well as the related developments in groupware and workflow systems, is that researchers and developers from a number of disciplines have come together, but each has had its own set of issues, its own priorities, its own familiar literature, its own conferences, its own development focus, and its own terminology or language for discussion.

Should CSCW become a "field" or a discipline? Liam Bannon has been particularly eloquent in arguing this case [5, 6]. However, this has not really happened. There are many relevant technologies, such as computer-supported design (CAD), manufacturing (CIM), software engineering (CASE), education (CSCL), and so on that are not discussed at CSCW and groupware conferences, and the people who do attend CSCW meetings show no signs of abandoning their previous professional fields to create a new one.

Thus, I think it is much more useful to think of this not as a new field, but rather as a forum, a marketplace. People come to a forum from different places, with the goal of browsing to see what is available. There is no expectation that everything will be useful, and some acquisitions may have to be adapted to be used. Not everyone in a forum may speak the same language or have the same background, but rather than a source of frustration this simply encourages us to devise ways to communicate. Finally, at the end of the day, everyone returns to their own home from the forum.

Those who expect everyone in CSCW to have the same priorities, knowledge, and terminology are often puzzled and frustrated. It is extremely helpful in understanding the work in this area to reflect on who the workers are, where they came from, why they have come, and what they are offering. To do this requires looking back a few decades. Understanding the history also may enable us to better anticipate the future. I will not try to paint a broad picture of the future, but will pick out an important development that comes into focus when we merge technical and social science insights from CSCW.

2 CSCW, Groupware & Workflow

The terms CSCW, groupware, and workflow are used differently, so I will describe how I use them. The focus of CSCW is "work," bringing together social scientists, technology developers, and others. One central question is "is a technology used by individuals, or is it used by groups?" For example, at a CSCW conference we may learn that a spreadsheet designed for individuals is often used by small groups. CSCW looks beyond applications to the organizational impact of technology and addresses the co-evolution of technologies, organizations, and societies.

Groupware, in contrast, has a software focus, and even a product focus, given that groups are too small to merit substantial custom development. The focus is on groups, not organizations. Central questions here are "is the technology designed for individual use, or for group use? Does it recognize different users or different roles?" It can be fashionable to be labeled 'groupware,' so we have to look closely.

Workflow is a more recent term applied to using technology to support group processes in their organizational contexts.

Figure 1 elaborates the familiar task time and place division of groupware, enabling us to see where workflow fits.

PLACE \ TIME	Same	Different but predictable	Different and unpredictable
Same	Meeting facilitation	Work shifts	Team rooms
Different but predictable	Teleconferencing Videoconferencing Desktop conferencing	Electronic mail	Collaborative writing
Different and unpredictable	Interactive multicast seminars	Computer bboards	Workflow

Figure 1: Groupware activity categories

Such categorizations can help us place a groupware application, but CSCW workplace studies emphasize that most real work does not fit in one category or another, it moves seamlessly across them. Thus, to succeed, developers must consider the complete task to be supported.

3 Historical Influences

3.1 Software R&D Foci

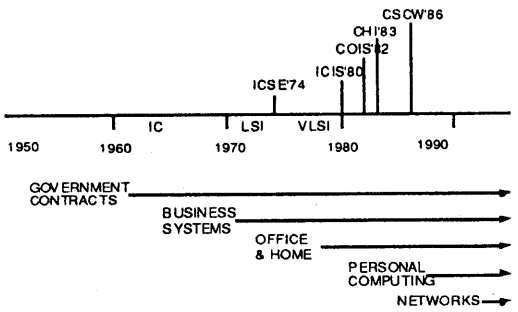

Figure 2: Major emerging R&D foci

Figure 2 shows the emergence of major software development industries centered on mainframe, minicomputer, personal computer, and network technologies. The first computers, built without integrated circuits, were very expensive; government contracts were the source of most such projects. Business systems, "office automation" centered on minis, the PC industry, and finally networked workstations and PCs followed.

Above the line appear the first meetings of major research conferences focused on software engineering (which arose to address problems in contract development), information systems (large business systems), office information systems, human-computer interaction (centered on PC applications), and CSCW, arriving as networking took hold. Some issues overlap across these systems development and research domains, but they have remained separate, and influences that they have exerted on one another can be illuminating.

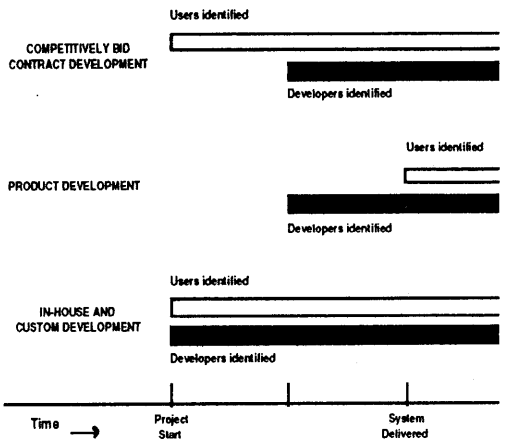

Figure 3: Identifying users and developers

3.2 Differences among R&D contexts

As we consider interactive, "end-user" applications, the main groupware focus, we find major differences in the conditions surrounding competitively-bid contract development (the origin of most software engineering), product development (the first major focus of human-computer interaction), and in-house development (the focus of information systems research). Figure 3 illustrates one of several distinctions, the moment in a project when the development team and the users are known with certainty.

Reflecting on this, it is unsurprising that different systems development approaches might be appropriate, but efforts were made to apply waterfall models everywhere. The waterfall model was developed primarily to address problems in the contract development of generally non-interactive or batch systems, and it was best suited for that context.

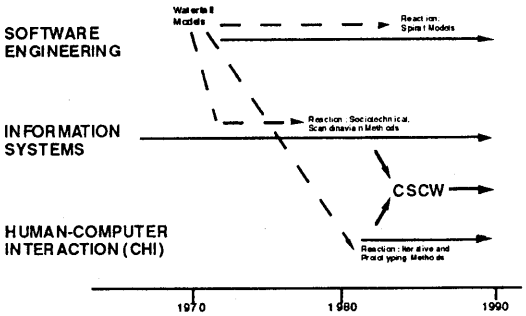

Figure 4: Reactions to the waterfall model

As shown in Figure 4, when waterfall models were applied to in-house development, their lack of sustained user involvement in development made less sense, and the sociotechnical and Scandinavian development approaches were proposed. For highly interactive systems in the HCI context, prototyping and iteration were seen to be necessary; these were later brought into software engineering spiral models.

CSCW draws heavily from two of these communities, information systems (oriented toward large systems) and human-computer interaction (oriented to small systems and software products). This history provides a partial view of some of the participants' differences in background and issues, and where they originated.

3.3 CSCW and product development

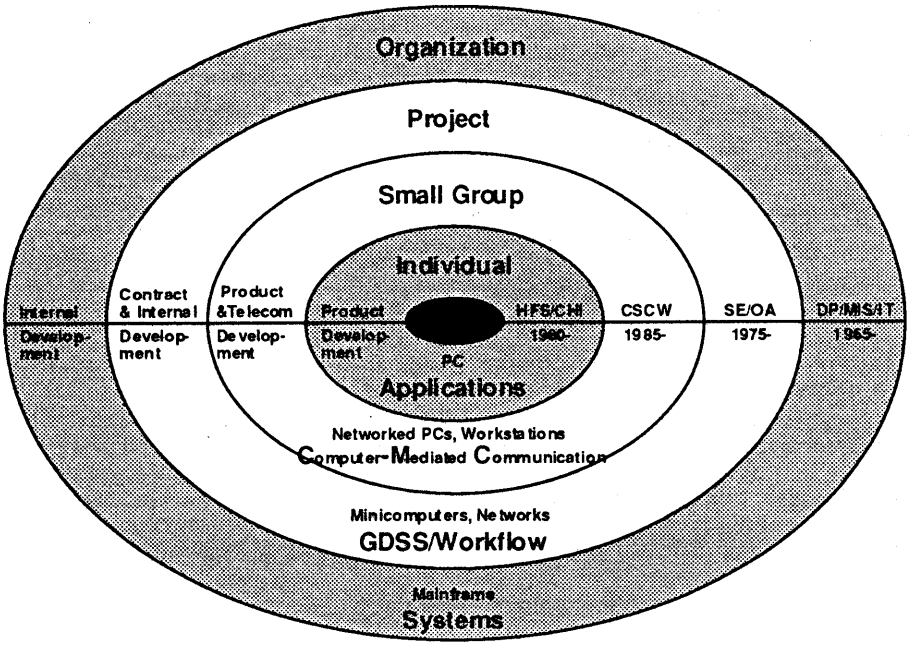

Figure 5: Research, development, and use contexts

Figure 5 brings together much of the preceding discussion. The outer ring represents large system development and an organizational focus: data processing (DP), management information system (MIS) or information technology (IT) fields. Much development here is internal.

The inner ring represents individual productivity applications developed mainly for PCs: Human factors (HF) and computer-human interaction (CHI) fields.

The two middle rings focus on groupware. Small-group applications have drawn the attention of product development and telecommunication companies; these primarily involve computer-mediated communication and run on networked PCs and workstations. Support for larger groups, roughly project size, remains a concern of software engineering and what remains of the minicomputer-based office systems context. Work on group decision support systems (GDSS) including electronic meeting rooms belongs here, as does the recent focus on workflow systems. Work here is often contracted or carried out at least in part internally.

CSCW has engaged social scientists, economists, management theorists, people focused on large systems development and use, among others, but the primary source of participants in the United States has been product developers and those with aligned research interests. Figure 6 contrasts attendance at the first three U.S. CSCW conferences and two European conferences (second and third columns) with that at CHI and ICIS (information systems) conferences from the same period. Japanese participation patterns resemble those of North America.

	CHI'90 (prog.)	CSCW'86-90	ECSCW/Crete	ICIS'90
Academic	40%	30%	70%[1]	85%
Product development	30%	40%	10%[2]	1%
Telecommunications	10%	7%	5%	0%
Other[3]	20%	23%	15%	14%

[1] Includes government research labs
[2] 2/3 from U S computer companies
[3] From Japan (over 30 CSCW'90 participants)
Product development 55%
Telecommunications 25%
2 of 30 papers presented

Figure 6: Conference attendance

4 Different emphases in CSCW

The perspective shown in Figure 5 is primarily that of North American and Japanese CSCW involvement. This is important to keep in mind when approaching the European CSCW literature, for it makes a valuable contribution, but can best be understood if the distinctions are appreciated.

Large product development (or vendor) companies are fewer in Europe and have less influence in academic and government research settings. As a result, the work in Europe tends to focus more on large systems and their impact in user organizations.

In addition, European CSCW is much more strongly grounded in theory, including philosophical, social, economic, and political theory. North American approaches tend to be empirical in two different senses of the word: There are more experimental, quasi-experimental, and statistical studies carried out, and there is a greater tendency to build systems and try them out to see what happens. The Japanese CSCW work published in English has also been empirical in the latter sense.

Work in England has bridged these two, centering on contributions from or supported by Rank Xerox EuroPARC. Technology development and ethnographic approaches are both represented. It is easy to speculate that a combination of factors are involved, including cultural bridging and the presence of numerous vendor company research centers in England.

The small system / large system contrast has numerous implications, some of which have contributed to misunderstandings in CSCW gatherings.

Small group support has focused on computer mediated communication, because small groups are often assembled because they have communication needs. In contrast, when the problems of organizations and other large groups are considered, issues of coordination often rise to the fore. Quite different technical and social issues are involved.

Small groups generally have a greater shared purpose, and developers intending to support them (for example, by developing a co-authorship system) are generally safe in assuming cooperation. This small-group orientation is reflected in the second "C" of CSCW. At the organizational level, not only can common goals not be assumed, but the presence of conflict can safely be assumed. Again, these different perspectives have different implications for design and use.

Applications developed to appeal to small groups enter a competitive market where functionality quickly matures. As a result, the human-computer interface becomes very important in distinguishing software. Large systems developers have less discretionary use to contend with and more need to focus on functionality.

Once these differences are understood, we can look past them for commonalties. Often, though, the differences are not understood and people never get past arguing over them.

5 A challenge for the future

I conclude by showing how synergies among the diverse threads present in CSCW can provide insight into challenges that lie ahead for us as we work on research, development, and on structuring our organizations and societies. I will draw on knowledge from social science, insights from technology experimentation, and observation of technological change.

Computation will inevitably be brought to bear to support work in many situations, and it is clear that if a system can incorporate greater understanding of work processes, it can better support them. The tendency has been to turn to the "standard policy manual," the official procedures for conducting work in an organization. It does not seem to make sense to try to support nonstandard procedures.

However, social scientists have recognized that "standard procedures" are often not intended to be followed literally. They may represent a goal to be striven for. They may represent an external face a company would like to present. They may represent a means of allocating responsibility for a breakdown, in full awareness that liberties must be taken. The use of "work to rule" as a means of sabotaging an organization is a reflection of the awareness that the rules are neither efficient nor generally followed. A system that forces an organization to follow such rules could be counterproductive.

Suchman [7] examined an apparently routine business process and showed that in practice it required considerable exception-handling and problem-solving. This and other studies reveal that the reality of work practices is much more chaotic than is

generally recognized. The orderly face presented to the outside world often masks a far less orderly internal operation.

This presents a problem for groupware developers, as illustrated by Ishii and Ohkubo [8]. In order to design a system to support office procedures, they first consulted the organization's "standard procedures manual." Realizing that it might be misleading, they conducted interviews to determine how people *actually* worked, which turned out to be quite different. They designed a system to support the "actual standard procedures" that people used. Nevertheless, upon completion, they found that the office work involved exception-handling that was beyond the capability of their system to address. Nor did they see hope of developing a system that could adequately cope with the level of exception-handling that they had discovered.

However, a more serious issue looms on the horizon. With the rapid development of communication technologies such as desktop videoconferencing and information sharing technologies such as the World Wide Web and Lotus Notes, the computer is becoming less of a "computing box" on our desk and more of a window onto the world. The window is by no means perfectly transparent—it filters, it selects—but the direction is toward far greater transparency, much more information available to us when we want it.

And this has many benefits. But one side effect, which may be a benefit in the long term or may not, but which will surely be disruptive in the short term, is that the window will reveal much of the underlying "chaos" or non-routine activity that Suchman and Ishii and Ohkubo reported. The masks and myths of smooth, consistent operation are being stripped away. As this process of revelation picks up steam, and because few people are aware of the degree of disorder that exists—our memory and our customs tend to suppress awareness of it—it will often be highly unsettling. We will see all the violations, all the irregularities, all the inconsistencies.

Possibly we can use technology to recreate the masks and the myths, but I doubt it, and I am not sure we would want to try. Perhaps these new technologies will be suppressed. But if not, their use will surely lead to the rapid evolution of new social practices and organizations.

6 References

[1] Grudin, J. (1991). Interactive systems: Bridging the gaps between developers and users. *IEEE Computer*, 24, 4, 59-69.

[2] Grudin, J. (1994). Computer-Supported Cooperative Work: History and focus. *IEEE Computer*, 27, 5, 19-26.

[3] Grudin, J. (1994). Groupware and social dynamics: Eight challenges for developers. *Communications of the ACM*, 37, 1, 92-105.

[4] Grudin, J. and Poltrock, S. (1995). Software Engineering and the CHI & CSCW Communities. In R. Taylor and J. Coutaz (Eds.), *Software Engineering and Human-Computer Interaction* (pp. 93-112). Springer Verlag Lecture Notes in Computer Science.

[5] Bannon, L. (1994). CSCW—Challenging Perspectives on Work and Technology. Unpublished manuscript.

[6] Bannon, L. and Schmidt, K. (1991). CSCW: Four characters in search of a context. In J. M. Bowers and S. D. Benford (Eds.), *Studies in Computer Supported Cooperative Work*, pp. 3-17. Amsterdam: North-Holland.

[7] Suchman, L. (1983). Office procedures as practical action: Models of work and system design. *ACM Trans. on Office Information Systems*, 1, 320-328.

[8] Ishii, H. and Ohkubo, M. (1990). Message-driven groupware design based on an office procedure model, OM-1. *Journal of Information Processing*, Information Processing Society of Japan, 14, 2, 184-191.