Proceedings of the Fourth European Conference on Computer-Supported Cooperative Work,
September 10–14, Stockholm, Sweden
H. Marmolin, Y. Sundblad, and K. Schmidt (Editors)

What Are Workplace Studies For?

Lydia Plowman
University of Sussex, UK

Yvonne Rogers
University of Sussex, UK

Magnus Ramage
Lancaster University, UK

We have considered the role of workplace studies from the CSCW literature which are intended to inform system design and implementation. We present a critique of these studies, categorised according to which phase of the design process they most inform, and discuss the tensions between providing explanatory accounts and usable design recommendations, the pressures on fieldworkers to provide both, the purposes different approaches serve, and the transition from fieldwork to system design.

Introduction

Workplace studies intended to inform system design have become increasingly prominent in computer supported cooperative work (CSCW). Their primary role is to convey the importance of the sociality of work by shedding light on the complex actions and interactions that occur. Every workplace setting is unique and this is reflected in the interpretations of formal and informal work practices in various studies. But how effective is the field study approach for informing design? Is it desirable, practical, useful and economical for a workplace study to be carried out *ab initio* every time a CSCW system is to be developed or introduced into an organisation? Or is it now possible for the findings and insights gained from these disparate studies to be consolidated and generalised for application to other work

quantitative axis concerning the kinds of data under consideration; secondly, the extent of situatedness to be found in the study. These axes are of course continua rather than dichotomies: there are both 'semi-experimental' studies in real work settings using a hybrid of qualitative and quantitative methods and there are studies using qualitative methods in semi-situated environments.

Work studies and specific design guidelines

One of the precepts of ethnographically oriented workplace studies, and part of the rationale for favouring such approaches over more experimental methods, is that every work environment is unique, work practices are highly situated, and specific design solutions are needed for specific situations. Papers describing design guidelines for *specific* systems (as opposed to general design recommendations) may therefore be expected to constitute the largest of our categories.

However, such detailed design guidelines are typically absent from the standard format of CSCW conference or journal papers, which tend to offer a description of a case study, followed by an 'implications for system design' section at the end of the paper in which a number of highly generalisable or semi-intuitive recommendations are made. It is not our aim to devalue these findings - what may appear to be commonsensical requires the validation of studies undertaken in the context of use, and inevitably, not all partners in a design team will share an understanding of how 'commonsense' relates to CSCW. The question is why so few ethnographic studies result in specific design guidelines.

The growth in the number of projects involving liaison between academic researchers and industrial partners may suggest some reasons. Although researchers conducting field studies for an industrial partner often produce design guidelines for an intended specific system, they may meet a number of obstacles in delivering their findings to a wider audience, thus accounting for the apparent dearth of such studies. Recent funding initiatives in the UK often require the main consortium partners to be from industry, and one of the main purposes of research is now considered to be generation of revenue. This militates against basic research which has no obvious application, but also makes dissemination of findings from industry/academia partnerships more difficult as commercial sensitivity of information is paramount for projects aiming to find a competitive advantage in the marketplace. Publication of accounts of workplace studies may therefore be inhibited by the industrial vetting process. Specific design guidelines are more likely to be restricted to confidential internal reports with only high level findings being published in the CSCW literature. By the time that specific design guidelines can be made public, generally when the system is in use or commercially available, findings may be of less interest. Researchers may also meet resistance from other parts of the team, such as sales, finance or marketing departments, who feel that various design inputs are inappropriate or too expensive to implement. Once design

guidelines are offered there is a focus for disagreements, factions may surface within the team, and major recommendations can be overturned, ignored or diluted.

Within the CSCW literature selected for this paper, studies which resulted in the most specific system requirements describe workplace studies supplemented by other methods (Streitz *et al.*, 1994; Tang & Isaacs, 1993) and as the main objective of these two projects was to develop a prototype, it is not surprising that their emphasis is on specific design. Examples of specific design guidelines may be found in other sources, where the emphasis is more on technical issues than their genesis. For instance, Ian Rogers (1995) describes a 'to do' list on a tool to support the process of complex electronic systems design by a salesperson. The 'to do' list guides the user to a correctly constructed design artefact by allowing any sequence of changes rather than imposing a pre-ordained sequence. If the changes introduce errors or mean that certain requirements have not been met a short description appears as an aide-mémoire. This is a specific design feature, implemented in a prototype, which is an outcome of findings from workplace studies which showed that the sales team simultaneously capture requirements and design the equipment in the customer's presence and they do not want to be hindered by a system which constrains their existing methods of working. However, the fact that this design feature was implemented as a result of the designer's creative response to the workplace study is not mentioned in the paper. It is difficult to ascertain how many other similar examples exist, in which the relationship between specific design features and the workplace study is invisible to those outside the project. But this example is also a demonstration of how a designer interprets the general findings of a workplace study through reading internal reports and discussions with the researcher rather than being presented with a specific design guideline which they then implement.

The paucity of papers detailing specific design guidelines can therefore be attributed to the lack of reported research which has developed to the stage of a system prototype (see figure 1) and to the constraints within which researchers working with industrial partners operate. It does not constitute enough evidence for the assertion that workplace studies do not produce specific design guidelines; it is more likely that our selection of CSCW literature has failed to capture papers which fall into this category, either because they are published elsewhere or because they do not make clear the provenance of described design features.

Work studies and general design recommendations

One of the strengths of an ethnographic approach is that detailed analyses of work can provide rich material on which to ground *general* design recommendations which are publishable and therefore more potentially influential than specific design guidelines. This category of papers has the highest output and the presentation of

recommendations ranges from sets of bullet points to hypothetical scenarios, and from the tokenistic to the highly influential.

It is as iniquitous to expect researchers to produce highly specified design guidelines for systems designers as it is to expect systems designers to 'assume responsibility for the redesign of work' (Shapiro, 1994) but these expectations still appear to be widespread. They are perpetuated in promises of such outcomes in proposals for funding and exacerbated to some extent by researchers' self-imposed demands to produce something obviously useful. This can result in zealous but inadequate attempts to meet these expectations, and perhaps accounts for the claims for contributions to design being very modest.

Studies are generally described as *informing* system design in the sense of 'imparting knowledge to', rather than 'giving form to'. Typical of this reticence are claims to offer only 'insights' (Heath & Luff, 1992), 'directions' (Filippi & Thereau, 1993), 'input' (Grønbaek *et al.*, 1992), 'suggestions' (Luff *et al.*, 1992), 'implications' (Beck & Bellotti, 1993), and 'options' (Egger & Wagner, 1993) for design. There is a strong impetus to provide recommendations, even when couched in these terms. Authors of studies which make a valuable theoretical contribution to CSCW feel obliged to force design guidelines from their data, resulting in the classic 'implications for design' section at the end of a paper. Even those bold enough to state that it is 'no part of our remit to produce actual design solutions' (Rouncefield *et al.*, 1994) seem driven to provide such a section.

How to present design recommendations in a way that is practically useful is a central concern. Hughes *et al.* (1992) comment that findings from workplace studies may appear troublesome or strange from a software engineering or HCI perspective because there is no formal modelling, data flow analysis or separation between function, implementation and interface. As a way of tackling the problem of translating from ethnographic analysis to design recommendations they opt for the unusual approach of positing different examples of electronic alternatives to the flight strip used during air traffic control. Although the various strips appear to fulfil requirements, they use the ethnographic analysis to demonstrate how some design options would offer impoverished support within the specific work context (Hughes *et al.*, 1993).

Alternative methods of structuring design recommendations are also found in Heath *et al.*'s (1993) analysis of share trading in a securities house in the City of London. They discuss different types of technological innovation, such as voice recognition, as an example of misinformed design and instead recommend adoption of a pen-based, handwriting recognition system. Beck and Bellotti (1993) take the approach of demonstrating the disparity between flexible low tech solutions and constraints imposed by new technologies by explicitly referring to design features of available systems for collaborative writing. This approach is also taken by Plowman (forthcoming) in her discussion of the interfunctionality of talking and writing. She speculates about ways in which these processes could be replaced or augmented technologically and discusses the limitations of systems which rely on

text to support collaborative writing. In their presentation of design guidelines, Katzenberg and McDermott (1994, p.204) use three imaginary scenarios 'as a basis for exploring solutions for support'.

Many studies aim to contribute both to broadening our understanding of work and to informing system design within the confines of one paper. Grønbaek *et al.* (1992), for example, state their aim to provide feedback for specific product development and for a long term vision of CSCW. Anderson and Sharrock (1993) claim that their paper is mainly an investigation of the sociology of cognition, but also provides a level of detail sufficient for 'design decisions to be framed and options to be ranked'. As this is an ambitious undertaking, it is not surprising that many offer little more than semi-platitudinous 'implications for design'. This entanglement is noted by Heath and Luff (1992), who criticise a number of studies which offer contributions to our understanding of collaborative work but have implications for the design and development of technology which 'appear to be difficult to draw'. Undeterred, they claim both to bridge the gap between naturalistic analyses of collaborative work and the design of technology, and to discuss implications for the development of systems in the Line Control Room of the London Underground, perhaps demonstrating the difficulty of escaping these pressures. Nevertheless, concepts such as surreptitious monitoring and the ways in which activities are rendered visible have permeated the field of CSCW so that designers now consider whether the location of screen information impedes or enhances this necessary, and often invisible, means of communication. Findings have therefore been of value beyond the particular system initially under consideration, but it would be difficult to make an assessment of this value. Whether we should be trying to measure outcomes as a way of validating workplace studies or whether we should avoid succumbing to these pressures is an unresolved issue.

Work studies as basic research

Several studies of the use of various technologies for work are primarily concerned with revealing interesting social phenomena and/or conceptual and theoretical concerns (Anderson *et al.*, 1993; Goodwin & Goodwin, 1995; Harper & Carter, 1994; Hutchins, 1995; Linde, 1988; Murray, 1993; Nardi & Miller, 1990; Suchman, 1987). Although they are sometimes dismissed with 'so what?' by designers, who may not use their findings explicitly, such studies can play an important role in shaping the concerns, issues and central questions of CSCW; as theoretical and conceptual contributions they are not susceptible to a checklist approach, but suffuse thinking about these issues. For example, Suchman's (1987) classic study is considered essential reading for sociologists, system designers and students of CSCW alike and has been much cited.

The influence of these field studies on system design is significant, albeit diffuse and difficult to quantify, and their findings have become distilled over a period of time to become almost part of the early folklore of CSCW. Some authors attempt to demonstrate their relevance to design by resorting to somewhat cursory generalising of their findings, as either a few bullet points or as a brief 'implications for design' section. If employers, funding bodies and others in the CSCW community were willing to value such research in its own right, these gestures at design 'relevance' would be unnecessary.

Some studies persuade researchers and designers to rethink some of the mainstays of CSCW. Although their study is brazenly non-applied, claiming that 'technological matters are eschewed', Harper and Carter (1994) provide a riposte to the commonplace that CSCW is concerned with bringing people together in demonstrating that keeping people apart may in some circumstances be more productive. Murray (1993) suggests that 'the group which most obviously appears to work together in teams may not be the most suitable one to consider when introducing new technology'.

The large research laboratories associated with companies such as Sun, Bell, Hewlett Packard and Xerox are responsible for a significant proportion of the output in publications considered here. Although they belong to multinational corporations in which one might expect many of the constraints of working with an industrial partner to operate, they may paradoxically offer more freedom to engage in 'blue sky' research. Opportunities for system designers and ethnographers to work in close proximity, and the saturation of research environments with communications technologies or radical innovations can be informative and result in valuable cross-fertilisation of ideas. For instance, research output from Xerox PARC and EuroPARC has provided a framework for thinking about privacy, control and feedback issues (Bellotti & Sellen, 1993) and interface design for media space technologies (Dourish & Bly, 1992).

Studies of the implementation and evaluation of CSCW systems in the workplace

There have been far fewer studies of the procurement, implementation and use of CSCW systems in places of actual work than studies intended to inform either CSCW in general or the design of specific systems. One reason for this imbalance is that groupware and multi-user systems for office support have only recently become widely commercially available. Another reason is that the focus of research has primarily been understanding the nature and requirements of existing cooperative work and communication practices for the purpose of informing the design of future systems. The need to inform the design and redesign of systems through evaluating the implementation of CSCW systems in actual work settings

has only recently been acknowledged (Bowers, 1994; Rogers, 1994; Sanderson, 1992).

The discrepancy problem and ways of managing it

Despite persistent appeals to engineer the 'the social' in with the technical, many CSCW systems have been developed and introduced into organisations without heed to such advice. Not surprisingly, field studies which have analysed the implementation of CSCW systems in work settings note how they have fallen short of expectations, being used sub-optimally, not at all, or in different ways than intended. It appears that there is a mismatch between the promises of software companies promoting their groupware products, management's expectations of how these can be realised in their particular organisations, and the changes in work practices that have to be adopted by employees to enable the groupware to work in the ways intended and projected. Accordingly, researchers have concerned themselves with describing the different ways in which this 'discrepancy problem' has manifested itself in organisations together with proposals for how collaborative work could be supported and facilitated more effectively.

The now 'classic' groupware failure, described by Grudin (1988), is the lack of uptake of electronic calendars which have automatic meeting scheduling facilities. The disruptive effects of implementing CSCW systems in work settings which benefit one group of users (usually management), but in doing so constrain those of another group using the same system, is explored further by Rogers (1994). Her field study of a new system in a travel centre analyses how it was designed to allow management and the accountancy department to carry out their work in a flexible and unconstrained manner. But the consequences are propagated to the sales consultants using the system further downstream, requiring them to carry out their tasks in a highly inflexible way and often resulting in extra work.

The different expectations of CSCW system developers and of users are another instance of the discrepancy problem. Star and Ruhleder (1994) point out how, in order to use a piece of customised communication software run over the Internet, the users (who are biology researchers) have to learn a vast array of skills and tap knowledge which is taken for granted by the developers.

Several studies make the general point that teething problems are inevitable when implementing CSCW systems into organisations. To manage 'the work to make a CSCW network work' (Bowers, 1994) requires supporting the process with various methods, conceptual tools and mechanisms. These need to co-evolve, so the CSCW system fits in with the current organisational structure whilst work practices are concurrently adapted to enable the system to support collaboration. One mechanism is the intervention of local technically skilled mediators, 'gardeners' or 'tailors', who take on board the responsibility of customising and shaping other users' adoption and understanding of the new system together with deciding on which work procedures to standardise (Gantt & Nardi, 1992; Okamura

et al., 1994; Trigg & Bødker, 1994). Here, the emphasis is on empowering and formally acknowledging key individuals within an organisation to facilitate the transition to collaborative working.

Resistance to collaboration

The need for co-adaption of CSCW tools and organisational practices so that they will be perceived to be of benefit by the employees is illustrated in two further field studies. Both used extensive in-depth interviewing and observational studies of work practices to analyse the implementation of Lotus Notes (Orlikowski, 1992) and networking software tools (Bowers, 1994) in established organisations. A general observation was employees' considerable resistance to working more collaboratively so that they could benefit from the functionality afforded by the new groupware tools. The reasons why they should share information and collaborate with others were not obvious to them given the individualised and competitive nature of the organisations.

The extent to which employees are willing to accept a new CSCW system also depends on how much it invades their privacy. In a study of active badges used to generate information about location of personnel, Harper (1992) found that there were significant differences in their use according to work roles: those whose job it was to keep tabs on people (especially receptionists) found them very helpful, while researchers perceived them to be an intrusion into their working patterns. This kind of observer-observee dichotomy was also found by Ramage (1994) in a study of the use of a workflow system within a financial services company. Workers felt that the system, while useful for scheduling work and providing summary information, had a 'big brother' nature in as much as managers could observe how much work they had done in some detail, but the manager found this useful as a way of ensuring her team was meeting its targets.

A further problem with implementing supplementary groupware support (tools which are not essential to the existing way of working but which are considered potentially useful for improving collaboration) is how it might aggravate or interfere with existing 'work arounds' that employees have developed informally. The clash between employees' self-constructed coping strategies and externally imposed groupware solutions is well illustrated in a field study by Harper and Carter (1994), who observed the outcome of installing a video link which was intended to facilitate collaboration between two groups working in the same architectural company. The anticipated benefits did not materialise as the two groups quickly realised that the video link was not helpful to them in their work. The study was also able to expose the nature of the actual problems that the two groups were experiencing, allowing the researchers to suggest quite different requirements for technological support.

Discussion

We have constructed a diagrammatic overview to show the various ways in which work studies have been used to inform system design and facilitate the implementation of CSCW in organisations. The figure is divided into three merging phases, each showing the kinds of research activities that take place at that stage in the design cycle and their potential outcomes. These are i) initial research and its implications, ii) the design and change phase, and iii) the evaluation and development phase. Invariably, workplace studies take place in phase (i) although others may follow the design and change phase.

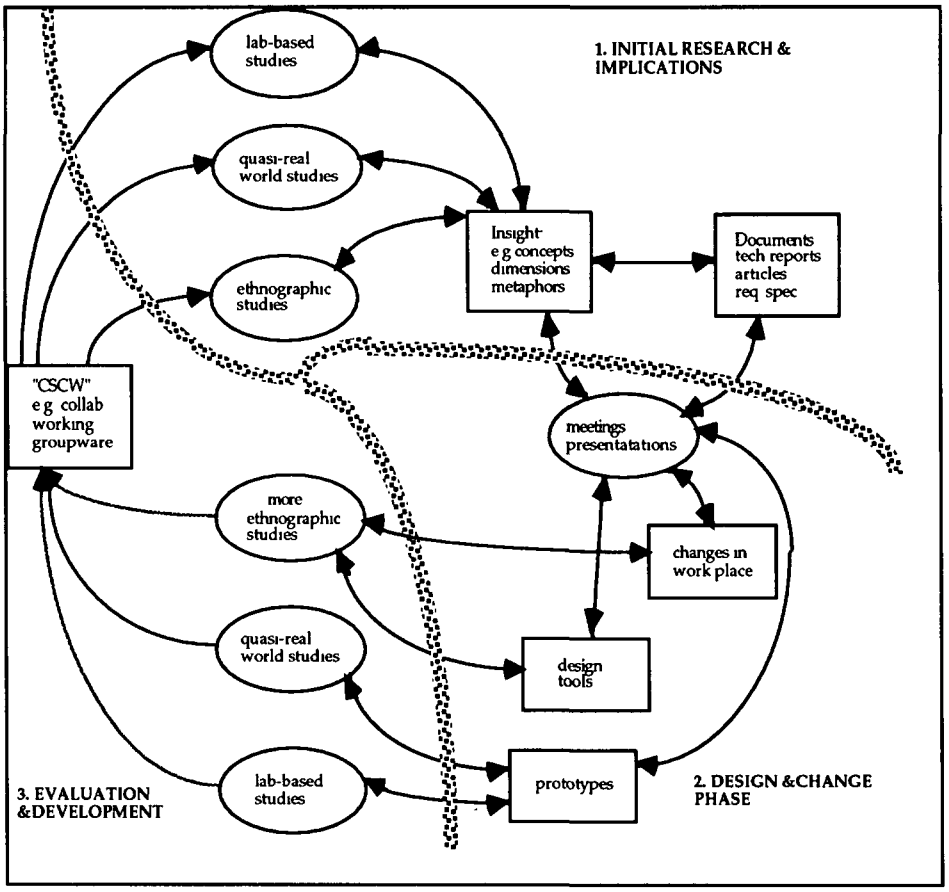

Figure 1: The role of workplace studies in the evolution of design and implementation of CSCW.

The main outcome of these studies is different forms of insight, which are usually reconceptualised at a more abstract level. Depending whether the study is government funded, self-funded or industrially-based, the abstractions are elaborated and documented in academic articles, technical reports or requirements

specifications. Because only the first two have tended to be available or cited in the CSCW community it is difficult to assess the extent of more formal documenting.

The findings are also disseminated and discussed at meetings with other interested parties (industrial sponsors, company managers, users, designers, other academics) and verbally presented at conferences. Many of the papers described in the section on studies leading to general design recommendations fit into this category. By and large, it is at this point that the research stops - at any rate, few further publications reporting further developments are to be found. Notable exceptions include researchers who have built software prototypes and design tools based on their initial workplace studies (e.g. the Lancaster CSCW research group), whilst one or two others, described in the implementation section, have proposed and instigated change in work practices during or following their fieldwork. These follow-ons are indicated by the arrows in phase (ii) of the diagram.

Further meetings and presentations may follow and other workplace studies may ensue, although not necessarily as a continuation of the original fieldwork. This is currently the most advanced stage of the evolution of CSCW design reached by any workplace project. At the same time, others who entered at phase (ii) have progressed to phase (iii), through commencing quasi-real-world studies of prototypes developed in the lab (Ackerman, 1994; Tang *et al.*, 1994). The ultimate goals of CSCW - to improve collaborative working and to design useful and used groupware systems - have yet to evolve convincingly and explicitly from the fruits of the earlier research-based activities. The question remains as to when and how this final phase will materialise. There are, however, several obstacles in the way.

The translation process

Many of the approaches advocated by social scientists for informing CSCW design are similar to those that have been applied by the cognitive sciences to interface design for single-user systems in HCI, such as design recommendations and building software prototypes and evaluation tools. So far there have been very few attempts to translate findings from workplace studies beyond the provision of a few general design recommendations. Moreover, fieldworkers are only too aware that their practical offerings are meagre and commonsensical compared with their rich and poetic accounts of the workplace. Whereas HCI researchers have found numerous ways of transforming their findings into practical implications and formal prescriptions that, arguably, have proved useful for designers, CSCW researchers are finding it much more difficult to follow suit. There is a real danger, therefore, that the 'nuggets of useful information' (Sommerville et al, 1993) generated from workplace studies may become marginalised before they have had the opportunity to show their value (Blomberg *et al.*, in press).

There are several issues at stake here. Firstly, workplace studies carried out primarily to understand a particular working practice are making a valuable contribution to the body of CSCW knowledge in their own right. As pointed out in

the section on basic research such studies can *inform* CSCW design through raising awareness of important conceptual issues and questioning taken-for-granted assumptions about work activities and how they should be supported. In essence, 'the main virtue of ethnography is its ability to make visible the 'real world' sociality of a setting' (Hughes *et al.*, 1994).

Secondly, is it unfair to expect any more from social scientists? As argued by Button (1993) and Shapiro (1994) the descriptive language and sociologically-generated analytical categories constructed in ethnographic studies are likely to be of little relevance to the practical problem of designing computer systems. Those who attempt to show explicitly the relevance of their research, may find that in the process of translating their detailed accounts into more formal requirements, the richness and significance of their work gets lost, distorted or misconstrued. But if researchers find it problematic reconceptualising their findings, what is it like for designers and consultants (whose job it is to implement new technology and redesign work) to translate descriptions of 'the sociality of work' into the language of design and workflow procedures?

Although some designers have been able to consider researchers' findings and implement them in their design of CSCW systems, we suspect that they are atypical. The majority of designers do not have the time, inclination or expertise to do so. Given the multiple constraints and deadlines that many have to work to, most designers are likely to prefer the translation work to be done for them, by using easily available 'cookbooks' containing step-by-step recipes for incorporating social aspects. But unlike other aspects of design, where it has been possible to provide such guidelines (e.g. ergonomically-based standards for screen and keyboard design) the sociality of work cannot be reduced to metrics.

What this reveals is a big discrepancy between accounts of sociality generated by field studies and the way information can be of practical use to system developers. This observation could lead us into thinking that bridging the gap between the social sciences and system design has proved to be too problematic and should perhaps be abandoned. Certainly, there is evidence of this kind of impatience influencing research funding bodies and commercial R&D departments. We believe that this market-led view of the value of work studies is short-sighted and needs to be reconsidered.

Given all the difficulties, what contribution can workplace studies make? It is clear that their contribution can be significant, if difficult to chart, whether they are intended to inform the design of specific systems, to produce more amorphous insights, or to increase our understanding of implementation processes. Following the aforementioned tradition, we propose:

- researchers who are directly involved in projects where system design guidelines are a required outcome may need to consider developing hybrid and tailored forms of ethnography which can play different practical roles in the various phases of design and implementation;

- researchers should not feel obliged to force design implications from their material;
- researchers and designers should engage more in a continuous dialogue to help bridge the gap and misunderstandings between 'techno-talk' and 'ethno-talk';
- workplace studies for 'their own sake' have played an important role in shaping CSCW and should continue to be supported unfettered to provide further insight into the social, the cognitive and the technical aspects of work.

Acknowledgements

Lydia Plowman is funded by EPSRC and DTI grant GR/J/53454. Magnus Ramage is funded by the EPSRC and the Digital Equipment Corporation. We thank John Hughes, Jonathan Grudin and the anonymous reviewers for their valuable comments.

References

Citations have been abbreviated as follows:

CSCW'86 *Proceedings of the Conference on Computer Supported Cooperative Work* (Austin, Texas, Dec. 3-5, 1986). ACM Press, NY.

CSCW'88 *Proceedings of the Conference on Computer Supported Cooperative Work* (Portland, Oregon, Sept. 26-28, 1988). ACM Press, NY.

ECSCW'89 J.M. Bowers & S.D. Benford (eds.) *Studies in Computer Supported Cooperative Work. Theory, Practice and Design.* (Proceedings of the First European Conference on Computer Supported Cooperative Work, 1989). North Holland, Amsterdam.

CSCW'90 *Proceedings of the Conference on Computer Supported Cooperative Work* (Los Angeles, CA., Oct. 7-10, 1990). ACM Press, NY.

ECSCW'91 L. Bannon, M. Robinson & K. Schmidt (eds.) *Proceedings of the Second European Conference on Computer Supported Cooperative Work.* (Amsterdam, 24-27 Sept., 1991). Kluwer, Dordrecht.

CSCW'92 J. Turner & R. Kraut (eds.) *Proceedings of the Conference on Computer Supported Cooperative Work* (Toronto, Canada, Oct.31-Nov.4, 1992). ACM Press, NY.

ECSCW'93 G. de Michelis, C. Simone, & K. Schmidt (eds.), *Proceedings of the Third European Conference on Computer Supported Cooperative Work.* (Milan, Italy). Kluwer, Dordrecht.

CSCW'94 R. Furuta & C. Neuwirth, (eds.) *Proceedings of the Conference on Computer-Supported Cooperative Work*, (Chapel Hill, North Carolina, Oct. 22-26, 1994). ACM Press, NY.

Ackerman, M. (1994). 'Augmenting the organizational memory: a field study of Answer Garden', in *Proceedings of CSCW'94*, pp.243-252.

Anderson, R., G. Button & W. Sharrock (1993). 'Supporting the design process within an organisational context', in *Proceedings of ECSCW'93*, pp. 47-60.

Anderson, R. & W. Sharrock (1993). 'Can organisations afford knowledge?' *Journal of Computer Supported Cooperative Work* 1 (3) 1993 pp. 143-161.

Beck, E.E. & V. Bellotti (1993). 'Informed opportunism as strategy: supporting coordination in distributed collaborative writing', in *Proceedings of ECSCW'93*, pp. 233-248.

Bellotti, V. & A. Sellen (1993). 'Design for privacy in ubiquitous computing environments', in *Proceedings of ECSCW'93*, pp. 77-92.

Blomberg, J., L. Suchman & R. Trigg (forthcoming). 'Notes on the Work-Oriented Design Project in Three Voices'. To appear in G. Bowker, L. Star, & B. Turner (eds.) *Bridging the Great Divide: Social Science, Technical Systems and Cooperative Work.* MIT Press, Cambridge, Mass. (in press).

Bowers, J. (1994). 'The work to make a network work: studying CSCW in action', in *Proceedings of CSCW'94*, pp. 287-298.

Button, G. (ed.) (1993). *Technology in Working Order.* Routledge, London.

Dourish, P. & S. Bly (1992). 'Portholes; supporting awareness in a distributed work group', in *Proceedings of CHI'92*, (May 3rd-7th, Monterey, CA.), pp. 541-547. ACM, N.Y.

Egger, E. & I. Wagner (1993). 'Negotiating temporal orders - the case of collaborative time management in a surgery clinic.' *Journal of CSCW* 1 (4) 1993, pp. 255-275.

Filippi, G. & J. Thereau (1993). 'Analysing cooperative work in an urban traffic control room for the design of a coordination support system', in *Proceedings of ECSCW'93*, pp. 171-186.

Gantt, M. & B.A. Nardi (1992). 'Gardeners and gurus: patterns of cooperation among CAD users', in *Proceedings of CHI'92, Human Factors in Computing Systems* (May 3rd-7th, Monterey, CA.), pp. 107-118. ACM, N.Y.

Goodman, G. & M. Abel (1986). 'Collaboration research in SCL', in *Proceedings of CSCW'86*, pp. 246-251.

Goodwin, C. & M.J. Goodwin (in press). 'Formulating planes: seeing as a situated activity', in *Communication and Cognition at Work*, eds. D. Middleton & Y. Engeström. CUP, Cambridge.

Grønbaek, K., M. Kyng & P. Mogensen (1992). 'CSCW challenges in large-scale technical projects - a case study', in *Proceedings of CSCW'92*, pp. 338-345.

Grudin, J. (1988). 'Why CSCW applications fail: problems in the design and evaluation of organisational interfaces', in *Proceedings of CSCW'88*, pp. 85-93.

Harper, R. & K. Carter (1994). 'Keeping People Apart.' *Journal of CSCW* 2 (3) pp.199-207.

Harper, R. (1992). 'Looking at ourselves: an examination of the social organisation of two research laboratories', in *Proceedings of CSCW'92*, pp. 330-337.

Heath, C., M. Jirotka, P. Luff & J. Hindmarsh (1993). 'Unpacking collaboration: the interactional organisation of trading in a city dealing room', in *Proceedings of ECSCW'93*, pp. 155-170.

Heath, C. & P. Luff (1992). 'Collaboration and control: crisis management and multimedia technology in London underground control rooms.' *Journal of CSCW* 1 (1/2) pp. 69-94.

Hughes, J., V. King, T. Rodden & H. Andersen (1994). 'Moving out from the control room: ethnography in system design', in *Proceedings of CSCW'94*, pp. 429-439.

Hughes, J., D. Randall & D. Shapiro (1993). 'From ethnographic record to system design. Some experiences from the field.' *Journal of CSCW*1 (3) pp. 123-141.

Hughes, J., D. Randall & D. Shapiro (1992). 'Faltering from ethnography to design', in *Proceedings of CSCW'92*, pp. 115-122.

Hutchins, E. (1995). *Cognition in the Wild.* MIT Press, Cambridge, MA.

Katzenberg B. & J. McDermott (1994). 'Meaning-making in the creation of useful summary reports', in *Proceedings of CSCW'94* , pp. 199-206.

Linde, C. (1988). 'Who's in charge here? Cooperative work and authority negotiation in police helicopter missions', in *Proceedings of CSCW'88*, pp. 52-63.

Luff, P., C. Heath & D. Greatbatch (1992). 'Tasks-in-interaction: paper and screen based documentation in collaborative activity,' in *Proceedings of CSCW'92*, pp.163-170.

Murray, D. (1993). 'An ethnographic study of graphic designers', in *Proceedings of ECSCW'93*, pp. 295-309.

Nardi, B. & J.R. Miller (1990). 'An ethnographic study of distributed problem solving in spreadsheet development', in *Proceedings of CSCW'90*, pp. 197-208.

Okamura, K., M. Fujimoto, W. Orlikowski & J. Yates (1994). 'Helping CSCW succeed: the role of mediators in the context of use', in *Proceedings of CSCW'94*, pp. 55-66.

Orlikowski, W.J. (1992). 'Learning from Notes: organisational issues in groupware implementation,' in *Proceedings of CSCW'92*, pp. 197-370.

Plowman, L. (forthcoming). 'The interfunctionality of talk and text', to appear in *Journal of CSCW*.

Ramage, M. (1994). *Engineering a smooth flow? A study of workflow software and its connections with business process reengineering.* Unpublished MSc dissertation, University of Sussex, UK. Available from author.

Rogers, I. (1995). 'The use of an automatic 'to do' list to guide structured interaction', in *Proceedings of CHI'95*, (May 7-11, Denver, Colorado). ACM Press, N.Y.

Rogers, Y. (1994). 'Integrating CSCW in evolving organisations,' in *Proceedings of CSCW'94*, pp. 67-78.

Ross, S., M. Ramage & Y. Rogers (1995). '*PETRA: Participatory Evaluation Through Redesign and Analysis*', CSRP no. 375, School of Cognitive and Computing Sciences, University of Sussex.

Rouncefield, M., J. Hughes, T. Rodden & S. Viller (1994). 'Working with 'constant interruption': CSCW and the small office', in *Proceedings of CSCW'94*, pp. 275-286.

Sanderson, D. (1992). 'The CSCW implementation process: an interpretative model and case study of the implementation of a videoconference system', in *Proceedings of CSCW'92*, pp. 370-377.

Shapiro, D. (1994). 'The limits of ethnography: combining social sciences for CSCW', in *Proceedings of CSCW'94*, pp. 417-428.

Sommerville, I., T. Rodden, P. Sawyer, R. Bentley & M. Twidale (1993). 'Integrating ethnography into the requirements engineering process', in *Proceedings of the IEEE Requirements Engineering Conference*, San Diego.

Star, S.L. & K. Ruhleder (1994). 'Steps towards an ecology of infrastructure: complex problems in design and access for large-scale collaborative systems', in *Proceedings of CSCW'94*, pp. 253-264.

Streitz, N., J. Geissler, J. Haake & J. Hol (1994). 'DOLPHIN: Integrated meeting support across local and remote desktop environments and liveboards', in *Proceedings of CSCW'94*, pp. 345-358.

Suchman, L. (1987). *Plans and Situated Actions: The Problem of Human-Machine Communication.* Cambridge University Press, Cambridge.

Tang, J., E.A. Issacs, & M. Rua (1994). 'Supporting distributed groups with a Montage of lightweight interactions', in *Proceedings of CSCW'94*, pp. 23-34.

Tang, J. & E. Isaacs (1993). 'Why do users like video? Studies of multimedia-supported collaboration.' *Journal of CSCW*1 (3) 1993, pp. 163-196.

Toth, J. (1994). 'The effects of interactive graphics and text on social influence in computer-mediated small groups', in *Proceedings of CSCW'94*, pp. 299-310.

Trigg, R. & S. Bødker (1994). 'From implementation to design: tailoring and the emergence of systematization in CSCW', in *Proceedings of CSCW'94*, pp. 45-54.