

Moving Out from the Control Room: Ethnography in System Design

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ABSTRACT

Ethnography has gained considerable prominence as a technique for informing CSCW systems development of the nature of work. Experiences of ethnography reported to date have focused on the use of prolonged on-going ethnography to inform systems design. A considerable number of these studies have taken place within constrained and focused work domain. This paper reflects more generally on the experiences of using ethnography across a number of different projects and in a variety of domains of study. We identify a number of ways in which we have used ethnography to inform design and consider the benefits and problems of each.

KEYWORDS: Systems Design and Development, Ethnographic Study, Design Methods, Studies of Work.

INTRODUCTION

Within CSCW, ethnography has acquired some disputed prominence as an important new method of 'requirements elicitation'. More specifically, it is a response, as is CSCW itself, to the need for an adequate analysis of the sociality of work and organisation to underpin large scale interactive system design. To date, and in the context of system design broadly conceived, such studies have included photocopier use [29], office work [31], air traffic control [14,13], police work [1], and Underground Control Rooms [16]. However, ethnography though holding much promise is still a relatively untried method in system design. It has been, and still is, strong on its critique of other methods, such as Task Analysis [9], but it has yet to prove itself within the wider community of software engineering, particularly those working in commercial and industrial contexts.

In this paper we intend a retrospective look at our own experience of using the method and suggest some roles which ethnography can play as a contributor to CSCW

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system design. Though we are strong aficionados of the method we do not regard it as a panacea for the problems of system design which are complex and 'wicked' [24]. In other words, if ethnography is to take a more regarded place in CSCW design, then it is important to appraise not only its virtues but also its vices. Here we identify four uses of ethnography in various phases of the design cycle as a contribution to an evaluation of the method.

In this paper we briefly examine the arguments which have motivated the introduction of ethnography into systems design. We then reflect on our particular experiences in the use of ethnography across a number of projects and present some more general implications arising from them.

THE CASE FOR ETHNOGRAPHY IN CSCW

Although it is not our intention here to review the history of either CSCW or systems design which has been done elsewhere [12,4] it is worth briefly reflecting on the rationale for ethnography in CSCW systems design. Two trends have strongly motivated the prominence ethnography currently enjoys:

- The growing plausibility of the diagnosis that the reason why many systems fail is due to the fact that their design pays insufficient attention to the social context of work; a failure often attributed to the inadequacy of existing methods of requirements elicitation and work analysis [27].
- A growing awareness with the emergence of low-cost technology that the ubiquitous nature of networked and distributed computing pose new problems for design which require the development of new methods which analyse the collaborative, hence social, character of work and its activities.

The tentative incorporation in system design of a social perspective emerges from these two trends and the insistence that the computer moves into the world of work and organisation [11]. Given this 'turn to the social' and the need to study the 'real world' character of work, drifting toward sociology through ethnography is almost a natural inclination. Thus, in the way that HCI has previously looked to psychology for an understanding of human behaviour CSCW turns to sociology and in particular ethnography to provide insight into the social nature of work. The expectation is that requirements elicitation is to

be informed by an analysis of the 'real world' circumstances of work and its organisation [10].

This is reflected more generally in a growing awareness within the software engineering community that the understanding the 'social' real world is an important factor in software design and development [21]. There is, not surprisingly, some equivocation about just what the 'social' means in this connection. The influences have come from a number of different directions, including the sociology of technology, the sociology of industry, the sociology of organisations among them. Not all of these have a direct interest in sociology as an input to system design. (See Quintas [22] for a selection of papers.)

The main virtue of ethnography is its ability to make visible the 'real world' sociality of a setting.¹ As a mode of social research it is concerned to produce detailed descriptions of the 'workaday' activities of social actors within specific contexts [20,18]. It is a naturalistic method relying upon material drawn from the first-hand experience of a fieldworker in some setting. It seeks to present a portrait of life as seen and understood by those who live and work within the domain concerned. It is this objective which is the rationale behind the method's insistence on the direct involvement of the researcher in the setting under investigation. The intention of ethnography is to see activities as social actions embedded within a socially organised domain and accomplished in and through the day-to-day activities of participants. It is this which provides access to the everyday ways in which participants understand and conduct their working lives.

It is the ability of ethnography to understand a social setting as it is perceived by those involved in that setting (the archetypal users) that underpins its appeal to developers. However, it is not without its problems. There are, for example, those to do with presenting the results of ethnography in a form which is readily assimilable by designers. For many software engineers ethnography seems far too unsystematic a method, its results presented in a discursive form, design options are not clearly stated and do not attend sufficiently to engineering needs. Its virtues, in other words, become vices.

Against this is the argument that what is wrong with many of the traditional methods of system design is that they owe far too much to the needs of engineering with the result that crucial aspects of the 'real world' of work are obscured, misrepresented or never properly treated [26]. It is in this respect that 'analytic approaches', Task Analysis, Office Automation for example, which focus on the flow of data within a domain, are found wanting [28,30]. While it is accepted that a balance needs to be found between the requirements of engineering and the need to adequately characterise the domain of application, such methods are an intrusion of the 'engineering mentality' into areas where it

is inappropriate. The result is, so it is argued, that essential aspects of the socially organised character of the domain concerned are obscured or, worse, misrepresented. More specifically, the analytic deconstruction of work activities into ever more finely grained components removes the essential 'real world' features which make them practises within a socially organised setting. This complaint attacks the individualistic slant of the cognitivism which underlies 'analytic approaches' by acknowledging the implications of the observation that work is, typically, collaborative. Though the activities constituting work are done by individuals, they are performed within an organised environment composed of other individuals and it is this which gives shape to the activities as 'real world' activities. Thus, the focus of ethnography is on the social practises which enable the very processes which 'analytic methods' identify but which they decontextualise. It is through social practises that processes are established and, accordingly, rooted in socially achieved sets of arrangements.

There are, of course, many aspects to these kinds of arguments, some of which involve a critique of the nature of work in modern society and how current methods of design instantiate the dehumanising rationality of modernism.² Our own arguments for ethnography are more pragmatic in nature. If we accept that CSCW design needs to attend to the sociality of work, then any method must respect the nature of this phenomenon. However, many of the existing methods fail to sufficiently recognise the social nature of work. This is not a call for the wholesale abandonment of more formal methods; they, like ethnography, will need to find an appropriate place in design.³

Accordingly, although there is a case for ethnography in CSCW system design, at the present time it is a promissory note rather than a claim based on substantial achievement. Its main use has been in research and mainly field sites which are small scale involving highly focused interactions, such as control rooms. Accordingly, if it is to substantiate its case as a method of system design, it will need to go beyond these and, in addition, face up to the problems of large scale system development.

MOVING BEYOND RESEARCH

For our part we accept that there are very real problems in the design and development of large scale systems, problems which have been well-rehearsed in the literature [7]. Briefly, these have to do with obtaining adequate knowledge of the relevant domain, communicating this to designers and organising the process of system building. In commercial contexts these problems are deeply infused with the familiar commercial constraints of budgets, time and

¹ Ethnography has a long history in social research. See, for a review, Ackroyd and Hughes (2) for a brief overview. Also Hughes et al [18].

² See, for example, COMIC Deliverable 2.1 (7) for a review of some of these arguments.

³ We do recognise that matters are not quite so easily resolved. Many of the arguments about methods do involve critiques of their underlying presumptions. An example of this is the attack on the cognitivism which underlies many of the task analytic approaches.

resources.¹ In particular methods such as ethnography must service a number of demands if they are to be widely accepted in industry. Without this acceptance the use of ethnography in systems design runs the risk of becoming a research curiosity and, thus, devalued as a tool to support effective CSCW design.

As a number of studies have shown software engineers typically work under some pressure [8,5]; a pressure which is, in part, determined by market factors. However, the familiar moan that most system development projects are 'over time, over budget' cannot be entirely laid at the door of market pressures. Building large scale systems is a complex and difficult business. Many of them are 'one off' with little in the way of past experience to serve as a guide. It was problems such as these which provoked the development of software design methodologies to systematise and manage the process of design and development so that systems had a reasonable chance of meeting both technical and commercial targets. These pressures still hold true and apply equally well to ethnography.

On the face of it ethnography does not accommodate easily to the pressures of development. A set of tensions become apparent when we examine ethnography in the light of systems design and it is important that the role of ethnography is considered within this context. These tensions include the familiar pressures of scale and time and place new demands on ethnography in system design.

The problem of scale. To date the main use of ethnography has not only been within research settings but also confined to relatively small scale and relatively confined environments, such as control rooms and other micro interactional contexts. In such settings there tends to be a clear focus of attention for the participants, who are typically few in number, and in which there is a relatively clearly visible differentiation of tasks at one work site. For the lone fieldworker such sites are ideal. They minimise travel and communication problems, and all that the fieldworker needs to see is there in one place and can be gathered with a minimum of disruption. Scaling such inquiries up to the organisational level or to processes distributed in time and space is a much more daunting prospect in raising issues of depth and representativeness.

The pressure of time. As one of our computer science colleagues expressed it, ethnography is a 'prolonged activity' and in the context of social research can last a number of years, certainly time scales which would be considered a joke in software engineering. Added to this are the problems, noted earlier, of communicating ethnographic findings to designers. The output of ethnographic analyses are typically discursive and lengthy, looking nothing like the blueprint diagrams which are *de rigeur* in systems engineering.

The role of the ethnographer. Moving out of the research setting into a more commercial one also raises different sets of ethical responsibilities as well as making access to sites more vulnerable to the contingencies of the commercial and industrial world. Ethnography insists that its inquiries be conducted in a non-disruptive and non-interventionist manner, principles which can be compromised given that much of the motivation for IT is to reorganise work and, as part of this, often seek to displace labour. Less dramatically, but important nonetheless, fieldworkers not only require access to relevant sites but also need acceptance on the part of those who work in them. Protecting the identity of people, respecting the fact that the fieldworker is like a guest within their lives, and so on, become much harder to sustain in applied work of this kind.

Of course, few of these issues are easily solved. However, it is important not to be too ambitious for any method, least of all in software engineering where new methods follow one another with monotonous regularity. Design is, at best, a 'satisficing' activity, often dealing with 'wicked' problems [24] and a matter of doing the best one can with the resources available. Nevertheless, if it is accepted that designers should be informed about the social character of work, and that ethnography is an important means of gaining such knowledge, then serious attention needs to be given to the variety of ways in which ethnographic studies can be used by designers. What follows is an attempt to specify some of these ways using, in the main, our own experiences over four years of collaborative and interdisciplinary research. We do not offer these in anything other than the spirit of what can be done now. Research on ethnography and system design is continuing in a number of quarters and it may well be that in a few years the picture will be very different. For us, the important issue at the present time is to sensitise CSCW system designers to the sociality of work as systematically and as effectively as possible.

ETHNOGRAPHY IN SYSTEM DESIGN

The wish to incorporate ethnography into the already diverse collection of methods, tool and techniques used in system design must be viewed with some trepidation. While we accept the need for the inclusion of a social perspective on design we must be careful to avoid seeing ethnography as a ready-made solution. The experiences of ethnography within systems design are limited and, as pointed out earlier, mainly confined to small-scale settings and of highly focused activities

However, ethnography is a much richer method than these previous studies and reports of design experiences would have us believe. It is important that existing studies are complemented by a consideration of the variety of different ways in which ethnography can influence systems design. Our aim in this paper is to propose some different uses of ethnography within the design process. These are based, to repeat, on our own experiences gleaned from studies we have undertaken over the last four years. In this respect, the categories presented below represent a codification of the lessons we have learned rather than explicit strategies which

¹ This is not to say that research contexts do not have their constraints of budget, time and other resources, only that commercial software development has different ones.

directly informed the particular studies we use to illustrate the approach.

The different uses of ethnography within design we identify include:-

- **Concurrent ethnography:** where design is influenced by an on-going ethnographic study taking place at the same time as systems development.
- **Quick and dirty ethnography:** where brief ethnographic studies are undertaken to provide a general but informed sense of the setting for designers.
- **Evaluative ethnography:** where an ethnographic study is undertaken to verify or validate a set of already formulated design decisions.
- **Re-examination of previous studies:** where previous studies are re-examined to inform initial design thinking.

In the following sections we aim to suggest what each has to offer design and also identify some of the problems that could arise. These categories should not be read as if they were mutually exclusive ways of using ethnography in system design. As we will suggest, some of the uses could be harnessed together and the differences between them seen as differences of emphasis rather than sharp demarcations.

Design, as in so much else, is a matter of responding to contingencies of various kinds. What is also important to note is that the schema recognises that design objectives are themselves various and that this will have a bearing on the role of ethnography. In other words, while not necessarily buying into the picture of the design process as a series of discrete, clearly delineated and phased steps, it undoubtedly has different objectives at different stages and, accordingly, implications for how design needs to be informed by relevant information about the domain.

CONCURRENT ETHNOGRAPHY

This use is perhaps the one most commonly associated with design and the one most commented on (See, for example, [15,19]). It is a sequenced process in which the ethnographic investigation of a domain precedes the design development of the system. This is the method we followed in the design of a tool for the rapid prototyping of interfaces for controlling [6]. In this case a period of some four weeks ethnography in the London Air Traffic Control Centre (LATTC) was followed by a lengthy debriefing session involving both the fieldworker and the designers. Meanwhile, a first prototype was constructed. The process of fieldwork > debriefing > prototype iteration > fieldwork was repeated about four times until the team was satisfied that little more could be usefully gained by more fieldwork. The penultimate version of the system was then evaluated using working controllers. The process was a directed one in that each stage of the fieldwork was intended to target issues raised by the designers during the debriefings, although the first phase was more concerned with the very

important task of the fieldworker familiarising himself with the setting and the work of the controllers.

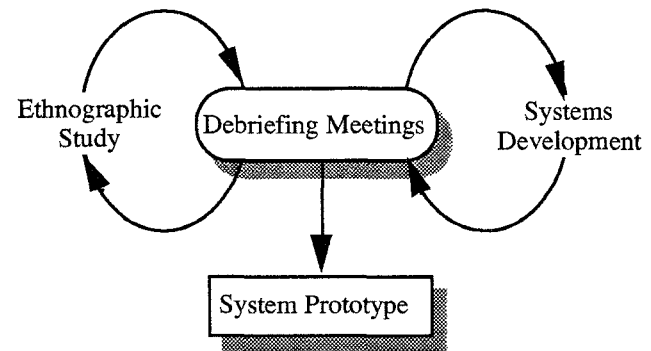


Figure 1 The use of Concurrent Ethnography

It is important to note that the aim of the project was research rather than the development of a system to be used in the 'front line' of controlling. Thus, we did not have the problems which would have arisen in implementing the tool. The research team was small so that much of the communication between the sociologists and the computer scientists could be done informally. There was no need for a requirements document or for a process model since the development work was done through rapid prototyping.

What the ethnography especially provided was a thorough insight into the subtleties involved in controlling work and in the routine interactions among the members of the controlling team around the suite; subtleties which were rooted in the sociality of the work and its organisation. The vital moment-by-moment mutual checking of 'what was going on' by the various members of the team had been missed by earlier cognitive and task analytic approaches to describing controlling work. What also became clear is that any new interface system would have to keep the controller 'geared into' the work by not automating, for example, the ordering of the screen-based flight strips. In other words, we felt it important to retain at least some of the functionalities of the current paper flight strips while, at the same time, being in a position to evaluate what information the controller needs, what is less important but needs to be 'ready to hand', and what was inessential.

We also learned that there was a declining rate of utility for the fieldwork contribution to the design. This is not to say that there was not more to learn or that we could not have learned more sociologically from further study of the control room, only that in terms of the project the 'fine tuning' of the design needed to be informed by experts actually using it. In other words, although there is always more to learn, the payoffs for design, at least in this case, came relatively quickly in comparison with social research uses of ethnography.

QUICK AND DIRTY ETHNOGRAPHY

This category is, in many respects, a rationalisation of the experiences of a project which did not go quite as intended, but which, and it is still ongoing, provided valuable

insights not only into the use of ethnography but also about the character of 'real world' software engineering design and, through this, some of the limiting conditions affecting the provision of computer support in CSCW contexts.

The principle distinction between this project and our previous experiences within ATC was the larger scale of the work setting. The ATC suite provided a natural focus and location for the work taking place. However, in the case of software development both the location and focus of work was considerably less apparent to both the developers and ethnographers and the issue of scale needed to be directly addressed.

Large scale settings

We have already noted some of the problems of scaling up ethnography beyond the confines of such as control rooms. In the case we use for illustration, the project was concerned to use an ethnographic investigation of software engineers at work in order to inform the design of a support tool; a tool which would, hopefully, enable designers to display the rationale behind their design choices and, through this, improve the quality of the system and the maintainability of the software. The aim was to develop a tool which more adequately reflected the collaborative and interdependent character of 'real world' design work. We planned to follow the pattern of the study mentioned previously; that is, a first period of familiarisation fieldwork while, at the same time, building the basic prototype, to be followed through by a series of iterations of debriefing, more directed fieldwork and prototype iterations. Although we had ready access to various sites, and to colleagues working in the same area, it was difficult to find projects we could study which were starting as opposed to those which were already some way along their development trajectories. Nevertheless, we felt that we would still gain a great deal for our purposes.

We realised from the beginning, and this was one of the purposes of the study, that the fieldwork would represent new challenges in involving a much less 'confined' field site than the control suite at LATCC. For one, the development engineers in both of the sites we eventually looked at, were working in industrial environments and, accordingly, subjected to a wider range of contingencies, events and policies which impacted more directly on their work. For example, one of the projects at the first field site was cancelled and access to another project within the same company proved more difficult due, to put it diplomatically, to one of the 'gate keepers', a team manager, being less than enthusiastic about a fieldworker studying a team under considerable pressure.

While we may have been unlucky in this case and more fortunate in the case of LATCC, it does highlight an important feature of ethnographic research, namely, its reliance on being accepted in the setting and, even if this is forthcoming, being subject to the range of contingencies that are capable of afflicting all 'real world' organisations.

Among these, of course, are those to do with, for want of a better phrase, the 'local politics' of the organisation.

In addition to these were the problems arising from asking a fieldworker to cover what proved to be a much larger task than we had anticipated. Software development is a complex business and tracking through its unfamiliar complexities, understanding the management of its components, seeing how the teams worked together, trying to figure out how the integration of the various components was achieved, and more, all proved to be a much more immense task than we envisaged originally.

Nevertheless, and despite less than ideal circumstances such as those noted, one can always learn something from ethnography. Indeed, seeing how the kind of contingencies we have reviewed can impact on design and development is important and, of course, illustrative of the argument CSCW makes about the necessity of studying the 'real world' circumstances of work to inform system design. In this case, we learnt sufficient about the design process as a 'real world' phenomenon to indicate that the tool as originally envisaged was, in significant respects, wrongly conceived. Briefly, it would only be effective if it was consistently used by members of project teams. However, in the conditions in which they typically worked, this would represent a considerable overhead. Also, given the personal and company investment in CASE tools of various kinds, persuading engineers to learn and use 'yet another bloody tool' when they were already less than enthusiastic about their current ones, would have been a mammoth task.

In the second site many of the problems indicated above also emerged. The development involved approximately a hundred software engineers working on an avionics systems for a new version of an aircraft. The work was organised according to a strict Process Model which was highly constrained, document driven and implemented under very tight budgetary constraints. This again provided insights into the 'real world' of design, particularly on the impact of management styles, the importance of professional pride the engineers exhibited in 'their craft', and a better understanding of the relationship of the Process Model used to organise the work to what actually goes on [25]. As far as the last point is concerned, in some respects the implementation of the work plan was so constraining that the engineers frequently made recourse to 'fixes' of various kinds in order to get the work done at all. Indeed, a surprising finding was the extent to which 'social and interactional issues' were constantly addressed with the aim of improving the efficiency and the quality of the work. For example, during the fieldwork the project team was reorganised to improve communication, the sharing of experience and skill, and various 'team building' exercises were arranged by management.

A quick and dirty approach

The phrase 'quick and dirty' does not refer simply to a short period of fieldwork but signals its duration relative to the size of the task. The use of ethnographic study in this

category not only seeks relevant information as quickly as possible but accepts at the outset the impossibility of gathering a complete and detailed understanding of the setting at hand. Rather the focus is informing strategic decision making to select those aspects of the work setting of particular importance in informing design.

There are two points of comparison with what we have called 'concurrent ethnography' that are worth noting. First, compared to the much more focused attention of 'concurrent ethnography', and this emerged in the example we have used out of the problems of access and those of finding a clear focus for the study, 'quick and dirty' ethnography is capable of providing much valuable knowledge of the social organisation of work of a relatively large scale work setting in a relatively short space of time, and this includes what we were able to learn from the organisational problems that arose when trying to establish the research site. Indeed, it can be argued that the 'pay off' of the 'quick and dirty' ethnography is greater in that for time expended on fieldwork a great deal is learned. Second, such knowledge can be built upon for a more focused examination of the detailed aspects of the work which is more typical of 'concurrent ethnography'. What the 'quick and dirty' fieldwork provides is the important broad understanding which is capable of sensitising designers particularly to issues which have a bearing on the acceptability and usability of an envisaged system rather than on the specifics of design. Both aspects, of course, are important.

The research also raised the problem of communicating the findings from the ethnographic study to designers, mainly because of the increased scale of the setting and the problems of finding a clear design focus. While the fieldworker learned a great deal in the study just discussed, certainly much that is useful for a sociological study, it proved difficult to hang this onto clearly formulated design objectives. In spite of this, even if used with this limitation 'quick and dirty' ethnography is capable of providing an informed sense of what the work is like in a way that can be useful for designers in scoping their design. In other words, although in our own case the research raised important questions about the initial design objectives, and this is not a pointless finding by any means, it did suggest useful ways in which ethnography could be used to provide designers with a better sense of the setting and its work activities.

EVALUATIVE ETHNOGRAPHY

The third category can be considered as a more focused version of the 'quick and dirty' in that while it does not necessarily involve a prolonged period of fieldwork, it is directed at a 'sanity check' of an already formulated design proposal; that is, it is used in evaluating a design.

The example we draw on to illustrate was research which involved approximately three weeks of fieldwork in two branch offices of a building society. It was commissioned by a computer company to check out, using ethnography, some aspects of a model the company was interested in using for IT developments in the financial sector. In

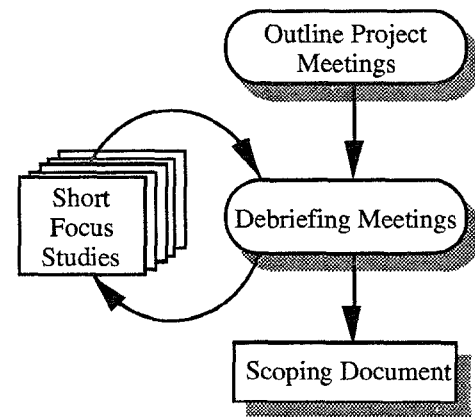


Figure 2: Quick and Dirty Ethnography

particular, we were asked to investigate customer relations at the front desk and mortgage processing.

In the relatively short period of fieldwork, it became clear that the model on offer had almost wholly ignored the character of 'front desk work' in branch offices, representing it as a series of information flows and tasks which could be unproblematically instantiated in the 'real world' conditions of branch work. Again in brief, much of this work was customer driven in the sense that the routine but essential work of processing the immense amount of paper that was generated was persistently interrupted by the need to serve customers or respond to their enquiries. Though, as said, much of the work was routine, including much of that with customers, there was an unpredictability to it in that cashiers did not know in advance what any particular customer wanted. Transactions with customers could be straightforward or involve complications of various kinds, neither of which was predictable. But, and customer satisfaction was an important element in the public face the company was anxious to promote, speedy and efficient service was important in the conduct of the branch's personnel. Among many other things, this meant that queues should not be allowed to build, a task which was difficult on particular days of the week due to specific local conditions. All of this was compounded by particularly unforgiving static screens which, given the complexities of even routine transactions, meant a laborious scrolling through of screens, a lack of confidence in much of the information displayed, and more, all of which occasioned considerable 'demeanour work' by cashiers in an effort to maintain 'customer satisfaction' [23].

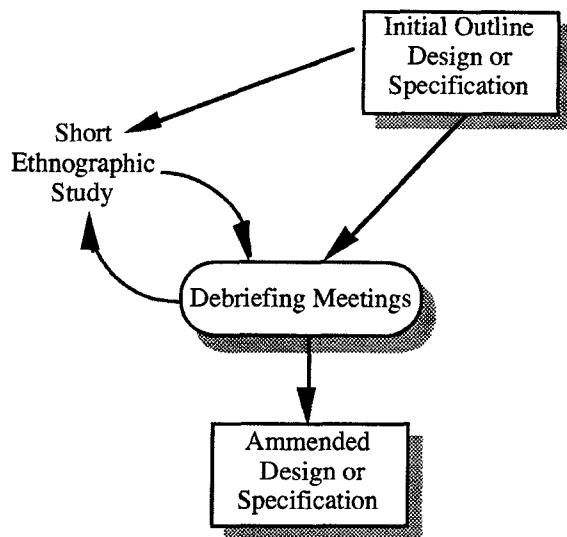


Figure 3: The role of evaluative ethnography

Another important aspect of the work, and one which aficionados of the 'paperless office' need to note, is that while there was already considerable IT technology in the branch, including help screens of various kinds, displays, remote terminals, and so on, the office space was full of 'personalised' items used by the staff in their work. Addresses of local solicitors, hints on who to call in case of particular problems, notes, and more. There was also a constant sharing of skill and experience during the work.

The above is, of course, again only a brief characterisation of the results of the ethnography. Nonetheless, they were sufficient to suggest that the model was, in significant respects, deficient. Such a conclusion is not necessarily of much comfort to designers who have, no doubt, spent many hundreds of 'person hours' developing the model. However, although in this case it reinforced the computer company's initial doubts, so much so that they withdrew from the negotiations to purchase the model, it is not difficult to see this use of ethnography in a more positive light. Independently of the commercial pressures which surrounded this project, the approach identified here could well be used to develop and improve system development. It is no part of our proposals about ethnography that it is a suitable replacement for other methods of software development or that the very real requirements of engineering are ignored in some cultic embrace of ethnography as the panacea to all the problems of systems engineering. As we have already indicated, and an important aspect of the rationale of this paper, the problems are to do with incorporating ethnography into the system design process in order to improve system design while recognising that this is, again as indicated earlier, a satisficing activity and one, moreover, governed and influenced, as it should be, by an interplay of political, moral as well as technological considerations.

However, important as these matters are, the immediate point we want to make is that this use of ethnography as evaluation could be developed as a systematic means of

monitoring systems in their use. Although human beings have an extraordinary ability to 'make do' with the technology with which they are provided, ethnographic studies could be useful in 'tweaking' existing systems and/or to inform the design of the next generation of systems. The first of these is, we suspect, of major relevance to many of the organisational contexts of IT use in which nothing is ever ideal. Investing considerable amounts of money in a new system is not an option for every organisation, and those who do often live to regret it. However, this proposal of continuous but modest redesign through periodic ethnographic field studies of system use may have considerable benefits if appropriately managed. And, again in support on one of the main tenets of CSCW, ethnography's focus places particular emphasis on the social context of innovation rather than simply allowing the technology to drive the innovation. It is in this context that the proposal for 'continuous but modest redesign', other things being equal, allows for persons using a system to make contributions to its evolution and contribute their skill and experience to the next generation of systems.¹

As an example of this process we can cite an ongoing field study of a technical documentation unit within a manufacturing company.² Although the research objective was to identify and analyse the characteristics of cooperative work arrangements, an important part of the study was to produce recommendations for changing the computer system, work organisation, and for training. What became clear was that the existing CAD system, despite the its lauded functionalities and the support of the system management, could not satisfactorily handle much of the materials that came through the unit. Part of the problem was that the drawings retrieved from the CAD database served other purposes, were often inconsistently layered, contained details not required for 'customer friendly' documentation, and more. Many drawings were not available in the system but existed as paper copies in a drawing archive. In other words, in order to get the work done the CAD users had to depart from the company's prescriptions and internal standards in order to produce a variety of effects which were not well supported by the existing CAD system.

It is studies such as this which, by closely attending to the details of the work and its arrangements rather than to idealised conceptions, can inform a process of design and redesign which does not restrict itself to the computer system.

¹ There are a whole host of sensitivities in this which go beyond the confines of system design, namely, the willingness of people to participate given that one of the options of such investigations is to use systems to dispense with labour. This issue, of course, is not peculiar to ethnography.

² This study was led by Risø as part of the COMIC Esprit Project in CSCW.

RE-EXAMINATION OF PREVIOUS STUDIES

One of the major problems that arises when new approaches, new methods, new systems are proposed is that not only do they challenge existing methods and approaches but there is also a lack of experience and a corpus of case studies, examples, exemplars, etc., which can be used either as sensitising material concerning a domain or, in some cases, informing preliminary design. Although ethnography is relatively new in systems design, it is, as we have pointed out, a method which has been used for many decades in sociology and anthropology. Many of these studies have been related to work and occupations and while not all of them have been studies of work of interest to system design, nonetheless, they can be informative.

In our own case, we have returned to previous ethnographic studies to inform the preliminary design of a Shared Object Service (SOS) platform which, among other things, is intended to handle documents in a wide variety of domains. The explicit aim of the project is to provide a set of services which allow objects to be shared by a community of users. The distinguishing feature from existing multi-user storage facilities is the focus on cooperative sharing across a group of users and the provision of mechanisms which support the management of this sharing. It is intended that the shared object service provide a set of facilities for a group of users which abstracts from the properties of the underlying infrastructure to provide a well defined set of cooperative facilities [17].

Though ideally 'concurrent ethnography' would have been an appropriate method to use because of the objectives of the research and the time scales involved, it was felt that much could be learned, and at relatively low cost, by using available studies even though they had not been carried out with system design in mind. What we were looking for were domains which would exhibit some of the varieties of document production, management and use as socially organised features of the work. To this end we chose studies of social work, police work and invoice processing in a multi-site fast food company. These represented a range of domains which, though not in any sense exhaustive of document use, enabled us to identify sufficient similarities and differences to inform the preliminary design of the SOS [1,32,3].

The use of a range of studies also holds the promise of uncovering some properties that generally hold true and a common service should support. For this reason, we suggest that this use of ethnographic materials is especially useful where obtaining sight of general infrastructural CSCW principles is the prime goal. In this respect, we learned the importance of history and record of use within the information store. Somewhat in contrast to current research trends non real-time interaction through access to common shared documents was prominent within our studies. The need for effective and dynamic management of

access to shared information was a central demand on the shared object service. Also of considerable importance was the need to manage considerable heterogeneity as part of the shared object service and to provide facilities that maintained links between electronic and paper records.

Of course, not all ethnographies easily lend themselves to system design objectives. Ethnographic researchers, like any other researchers, have their own objectives in mind which may not always, or even very often, accommodate to the specific interests of a particular system design problem. Indeed, we had to discard a number of excellent ethnographies for this reason. However, there is another important consideration here. Unlike many of the natural sciences and engineering disciplines, the social sciences, on the whole, have failed to produce a cumulative corpus of findings to underpin any application of their knowledge. Although this feature can be overdrawn even in the natural and the applied sciences, the situation is that the multi-paradigmatic character of social research makes it very difficult, not to say hazardous, to presume that there is an available bedrock of findings which designers can consult. There is little doubt, however, that designers would find such a corpus extremely useful, though it would need to be used with due caution. In other words, re-analysing ethnographic studies could well be a useful way of sensitising designers to the social organisation character of a considerable variety of settings. This is not a substitute for the more directed uses of ethnography when there are specific design issues to address but, depending on the design objectives, can perform a useful role in making designers aware of what to avoid and what the more specific issues might be.

SUMMARY AND LESSONS LEARNED

What we have tried to do in this paper is review some lessons from our experience of using ethnography in system design and proposed a number of uses to which the method can be put. As we said in the introduction, these are not to be taken as mutually exclusive, strictly demarcated methods but ones which, in significant respects, shade into one another. The motivation for this is part of a longer term attempt to place ethnography within the broader methodological context of system design in light of the focus of CSCW on 'real world' contexts of use. For CSCW it is vital that designers understand the work setting as a socially organised setting as a preliminary to design, and it is in this respect that ethnography has a role to play. In other words, the prime objective is not so much ethnography as such, but ethnography as a means of uncovering the 'real world' character of work, and it is by this test that ethnography needs to be judged in system design. Thus, it is a matter of looking at the method in light of the varied circumstances of system design, including those that arise in industrial and commercial systems development.

	Concurrent Ethnography	Quick & Dirty Ethnography	Evaluative Ethnography	Re-assessment of previous studies
Detail of Work	Dependant on focus of study	Outline understanding	Dependant on initial design/model	Dependant on Previous studies
Type of design information	Informing prototype through different stages of development	Overview of domain of work to inform initial design.	Check implications of design from initial model	Motivation and scope of design.
Duration of Study	12-14 Months, Balanced use of study/debriefing	2-3 Weeks of study prior to analysis.	Analysis of original model, 2-4 Weeks of study prior to re-assessment	No fieldwork but costs of reanalysis
Influence of Field site	Strong and unpredictable	Greater ability to select field	Dependant on field site and previous model	-----
Design / Study Relation	Driven by Study	Driven by Study	Driven by initial design/ model	Driven by outline design
Form of system	Interactive workplace systems with emphasis on detail of work	Interactive workplace systems and overall system structure	Interactive workplace systems and overall system structure	General platforms to support a range of different applications

Table 1 : Outline features of the different roles of ethnography in design

Of course, the judgement about ethnography, as about any method, is a long term business and one, moreover, which will be influenced not only by its results but also by what can only be described as 'methodological fashion'. This is not to say that methodological issues are only matters of fashion, but this is one of the factors which play their part in their acceptability in at least the short term. Ethnography is currently fashionable in CSCW but if it is to survive this kind of attention then it is important that the method find an effective voice rather than remaining content with ephemeral celebrity. In other words, we do not propose the above categories as solutions to the complex problems of system design; all we claim is that they have a useful contribution to make given the requirement for CSCW design to become sensitised to the social organisational context of work. The table above summarises some of the main points associated with the different role ethnography can play in design.

There are a number of specific lessons we think worth emphasising from our experiences of ethnography across a number of projects over the last four years. Our experiences and uses of ethnography have been quite varied during this period. Rather than adopting a particular stance we merely present these summarised below as a collection of our own pragmatic insights. Lessons of particular note include

A variety of roles for ethnography. in design. Designers require different information at different phases of the process: a point which has more than just a passing bearing on the role of any design method. While not wishing to become embroiled in the question, what is design?, it is a process which involves a number of skills though not all equally throughout. Some methods, for example, are intended for particular phases of system design. Process Models, for example, have their greatest utility when it

comes to integrating the output of a large number of software engineers. What we have suggested for ethnography is that it is a role to play in various phases of system design and makes different contributions to them. Further, and again this is a virtue which is dependent upon the point of the fieldwork, fieldworkers can be extremely flexible in their response to the various contingencies that can arise, and deal with them as they occur. The very engagement of a fieldworker within a 'real world' work setting presents opportunities to learn much about that setting which is relevance to design.

Responding to the pressure of time and budget. A charge often levelled at ethnography is that it is a 'prolonged activity'. As we have suggested, this is not quite the problem that it is imagined to be. Depending on the purposes of the design, much can be learned from relatively short periods of fieldwork. Indeed, within the context of design, and we emphasise this, diminishing returns to fieldwork set in relatively quickly. In other words, fieldwork of prolonged duration is not always necessary in that it would be more effective to direct that effort in accordance with design objectives once an effective understanding of the setting of the work and its characteristics has been obtained. This point is also relevant to the claim that ethnography is an expensive process in person effort expended, a critical issue in commercial environments where, often, the contract has been gained by cutting costs to the bone. These are, of course, complicated and disputatious matters but we can say that the problem is not as severe as it might seem.¹ In any event, if the argument

¹ Of course, at present ethnographers are, typically, academics whose salaries are relatively low. If ethnography ever became a consultancy practise, the costs would be much greater.

for ethnography is right, ignoring its value could be much more costly in inadequate systems and dissatisfied customers.¹

The importance of focus. A major determinant in the successful undertaking of projects involving ethnography was the question of focus. In our study of air traffic control and the subsequent development of the flight strips systems a natural focus was provided by the setting for the study. Work was oriented toward a control suite which was placed within a control room with the explicit intent of making work publicly available and accessible through manipulation of flight strips. In contrast, no single location or set of work activities existed which provided a complete insight into the work of software development. Much of the effort of ethnography was in determining this focus through a series of 'quick and dirty' ethnographic studies. An existing focus was also provided by the initial design intentions within the shared object service and the existence of a previous specification within the building society.

The importance of previous studies. One of the major problems of CSCW design, and one of the reasons for the turn to ethnography and studies of the social organisation of work, is that it represents a set of new challenges. This means that, to a degree, it lacks experience and a corpus of findings to draw upon. CSCW systems are likely to be if not quite the first of their kind, at least sufficiently innovative to pose challenges in which previous systems are likely to prove of little help. This also represents a challenge to ethnography and the contribution it can make, through an accumulation of its studies, toward informing 'good practise' in CSCW design. This means paying attention to the ways in which a corpus of studies can be made available to software engineering, and others involved in the design process, ways which while enunciating general features of the social organisation of work, also display the variety of ways in which these become instantiated in 'real world' contexts.²

Finally, and this is to reiterate one of the main virtues of ethnography, system design is work design. This is, we would suggest, an unalterable fact about system design, let alone CSCW system design, and one which is too rarely given the emphasis it deserves. Ethnography, by its nature, has to attend to this aspect even though its studies will be concerned with 'work as it is currently done'. Thus, even though design may be concerned with developing a completely new system, understanding the context, the people, the skills they possess, what kind of work redesign may be involved, and more, are all important matters for designers to reflect upon. It is also more capable than most methods of requirements elicitation, as it ought to be, in highlighting those 'human factors' which most closely pertain to system usage, factors which are not always just about good interface design but include training, ease of use

in work contexts full of contingencies which are not the remit of system design, and more. It is in respect of these considerations that ethnography is especially useful in CSCW design.

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REFERENCES

- 1 Ackroyd, S., Harper, R., Hughes, J.A., Shapiro, D., and Soothill, K. (1992), *New Technology and Practical Police Work*, Milton Keynes, UK: Open University Press.
- 2 Ackroyd, S. and Hughes, J.A. (1992), *Data Collection in Context*, London, Longmans.
- 3 Anderson, R.J., Hughes, J.A., and Sharrock, W.W. (1989), *Working for Profit: The Social Organisation of Calculation in an Entrepreneurial Firm*, Aldershot, UK: Gower.
- 4 Bannon, L. and Schmidt, K. (1991), CSCW: Four Characters in Search of a Context, in *Studies in Computer Supported Cooperative Work: Theory, Practice and design*, ed. J. Bowers and S. Benford, Amsterdam: North Holland.
- 5 Bansler, J.P. and Bødker, K. (1993), A reappraisal of structured analysis: design in an organizational context. *ACM Transactions on Information Systems*, 11(2): 165-193.
- 6 Bentley, R., Hughes, J., Randall, D., Rodden, T., Sawyer, P. Shapiro, D and Sommerville, I (1992), Ethnographically Informed System Design for Air Traffic Control, in *Proceedings of CSCSW '92*, ed. J. Turner and R. Kraut, 123-129, Oct.31-Nov.4, Toronto, Canada: ACM Press
- 7 Comic Deliverable D2.1, 'Informing CSCW System Requirements', Department of Computing, Lancaster University. ISBN 0-901800-29-5
- 8 Curtis, B., Krasner, H., and Iscoe, N. (1988), A field study of the software design process for large systems, *Communications of the ACM*, 31: 1268 — 1289.
- 9 Diaper, D. (ed.), *Task Analysis in Human Computer Interaction*, Ellis Harwood.
- 10 Goguen, J. (1993), Social issues in requirements engineering, in *Proceedings of RE 93: International Symposium on Requirements Engineering*, Jan 4-6, San Diego: IEEE.
- 11 Grudin, J. 'The Computer Reaches Out: The Historical Continuity of Interface Design.' *Proceedings of ACM CHI'90 Conference on Human Factors in Computing Systems. Evolution and Practice in User Interface Engineering*. pp. 261-268.
- 12 Grudin, J. (1991), CSCW: The convergence of two development contexts, In *Proceedings of CHI'91*, New Orleans: ACM Press.
- 13 Harper, R. and Hughes, J.A. (1992), "What a F-ing System! Send em all to the same place and then expect us to stop em hitting": Making technology

¹ Though, of course, there can be no question of guarantees here, but nor can there be with respect to any method.

² See Hughes et al (18) for a preliminary attempt at formulating such generic properties.

- work in air traffic control, in *Technology and Working Order: Studies of Work, Interaction and Technology*, ed. G. Button, 127-144, London: Routledge.
- 14 Harper, R., Hughes, J.A. and Shapiro, D. (1991), Harmonious Working and CSCW: Computer Technology and Air Traffic Control, in *Studies in Computer Supported Cooperative Work: Theory, Practice and Design*, ed. J. Bowers and S. Benford, Amsterdam, North-Holland.
- 15 Heath C, Jirotko M., Luff P., Hindmarsh J. 'Unpacking Collaboration: The interactional Organisation of Trading in a City Dealing Room', in de Michelis G., Simone C., Schmidt K. (eds): *Proceedings of ECSCW'93*, Kluwer Academic Publishers, ISBN 0-7923-2447-1, pp 155-171.
- 16 Heath, C. and Luff, P. (1992), Collaboration and control: Crisis management and multimedia technology in London Underground line control rooms, *Computer Supported Cooperative Work*, 1(1-2): 69-94.
- 17 Hughes J., King V., Mariani J., Rodden T., M. Twidale, "Paperwork and its lessons for database systems", *Proceedings of the 12th Schaerding International Workshop on Design Of Computer Supported Cooperative Work And Groupware Systems*, June 1-3 1993
- 18 Hughes, J.A., King, V., Randall, D. and Sharrock, W. (1993), *Ethnography for System Design: A Guide*, Working paper, COMIC-LANCS-2-4.
- 19 Hughes, J.A., Randall, D. and Shapiro, D. (1992), Faltering from ethnography to design, In *Proceedings of CSCW'92*, Toronto, Canada: ACM
- 20 Hughes, J.A., Randall, D. and Shapiro, D. (1993), From Ethnographic Record to System Design: Some Experiences from the field, *CSCW, An International Journal*, vol. 1 no 2.
- 21 Potts C. 'Software Engineering Research Revisited' *IEEE Software* Vol. 10 No 5, September 1993, pp 19-28.
- 22 Quintas, P. (1993) ed. *Social Dimensions of Systems Engineering: People, Processes, Policies and Software Development*, New York, Ellis Harwood.
- 23 Randall, D. and Hughes, J.A. (1994), Sociology, CSCW and Working with Customers', in Thomas, P. ed. *Social and Interaction Dimensions of System Design*, Cambridge, Cambridge University Press.
- 24 Rittel, H. and Webber, M. (1973), Dilemmas in a general theory of planning, *Policy Sciences*, 4(2): 155-169.
- 25 Rodden T., King V, Hughes J., Sommerville I. 'Supporting the software process as a social process', *Proceedings of EWSPT 94, 3rd European Conference on Software Process Technology*, 7-8 February 1994, Springer Verlag.
- 26 Schmidt, K. (1993), The Sociological Bonanza?, Working Paper, Comic Working paper, COMIC-RISØ-2-3, Department of Computing Lancaster University, Lancaster LA1 4YR, UK..
- 27 Schmidt, K. and Carstensen, P. (1993), Bridging the Gap: Requirements Analysis for System Design, Working Paper, COMIC-RISØ-2-2.
- 28 Shapiro, D. (1993), Ferrets in a sack? Ethnographic studies and task analysis in CSCW, presented at the *12th Schaerding International Workshop on Design Of Computer Supported Cooperative Work And Groupware Systems*, June 1-3, Elsevier Press
- 29 Suchman, L. Office procedures as practical action." *ACM Transactions on Office Information Systems*. 1, 1983, 320-328.
- 30 Suchman, L. (1983), Office procedures as practical action: models of work and system design, *ACM Transactions on Office Information Systems*, 1(4): 320-328.
- 31 Suchman, L., and Wynn, E., (1984), Procedures and problems in the office, *Office Technology and People*, 2: 133-154.
- 32 Wattam, C. (1992), *Making a Case in Child Protection*, London, Longmans.