CSCW2006 TUTORIAL: Supplementary Notes

Fieldwork for Design

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Abstract: Objectives of the tutorial

The tutorial develops and expands on a number of themes concerning the use of observational fieldwork methods.

The main emphasis in the tutorial is on some of the practicalities of actually 'doing' ethnography in real world, real time workplace settings. We examine the practice of fieldwork at a number of levels including the theoretical, conceptual and practical, and use our experience of working with design and management teams to illustrate many of the practical problems associated with doing fieldwork.

This tutorial is concerned with reflecting on and developing the practice of fieldwork in a range of settings. It is about sharing expertise and training. Our emphasis is on the everyday practice of fieldwork and its associated analysis. Fieldwork is a catch-all phrase for various forms of direct observation and analysis. Many of those who adopt fieldwork do so without any grounding in some important areas. These include; sociological, anthropological and psychological disciplinary assumptions; analytic choices of scope and granularity as they relate to the type of domain and system under investigation; competing theoretical claims; technological support for fieldwork; issues of generalisation and so on. Many of those who adopt fieldwork can be particularly ill-informed about what kind of fieldwork is appropriate for their particular task or what it entails. In particular, for those who wish to learn more there is a dearth of literature detailing the methodological assumptions underscoring the various approaches to fieldwork currently available and advocated by those working in the field – this booklet goes some way towards addressing that need (and our forthcoming book is even better).

The general need for this tutorial arises out of the growing importance of 'design' in a range of activities and the particular recognition that the commonly recognised, if much hyped, benefits of Information and Communication Technology (ICT) will only materialise if users, usability and dependability are central to the design process. 'Design' is used here in the sense of the practice of careful and thoughtful planning of activities and artefacts and is not merely about computer systems or machines but embraces interventions into social life of various kinds including devising policies, processes and practices – so, for example, 'leadership' can be designed, syllabuses can be designed, services for the elderly can be designed, exhibition spaces can be designed and so on. 'Technology' also has a wide definition encompassing a range of 'technological' artefacts including paperwork and everyday household objects and

communication devices. Given these understandings, the emphasis is consequently on design as a socio-technical enterprise. This reflects the fact that in recent years there has been an expansion of the notion of design to embrace a range of socio-technical issues of varying kinds concerned with spatiality, temporality, sociality and aesthetics. The domains and settings to which 'design' and technology is relevant has also expanded to embrace domestic settings, public spaces of various kinds, healthcare and other public services such as education and so forth.

The interdisciplinary nature of the design enterprise is reinforced by the commonplace observation that design now encompasses a range of considerations and disciplines rather than mere engineering or technology. In this sense the social scientist is an interdisciplinary team member where the overall, team, objective is some form of design intervention. Interdisciplinary communities such as Human Computer Interaction (HCI) and Computer Supported Co-operative Work (CSCW) have grown apace as various techniques and approaches from the human sciences have been explored and adopted for this purpose. One approach in particular has gained much prominence: fieldwork. With fieldwork, the social context in which systems are to be used can be better understood; with fieldwork the difficulty of extrapolating from the laboratory to the real world is obviated by commencing with the real world. Nevertheless, this has not necessarily resulted in uniformly better systems. This, we feel, is because fieldwork has been and remains a catch-all phrase which underplays the analytic and observational issues which define its usefulness. Fieldwork alone does not ensure good design.

Two main issues are behind this variable quality:

1.   Translating disciplinary assumptions into interdisciplinary working remains problematic, even for experienced practitioners.

2.   For the inexperienced, understanding the skills and sensibilities required for interdisciplinary work is daunting.

Intended Learning Outcomes:

Fieldwork must be adequate to interdisciplinary tasks. To ensure this, our emphasis is on the sharing of expertise and on training – these are skills that can be learned. If one were to glance at the CSCW literature and other related disciplines one will see that there is an emerging 'body politic', a set of tools and assumptions that are beginning to be used to evaluate and comment on matters of empirical adequacy, scope, relevance, tractability and so on. These tools can be acquired through training and the sharing of experience and expertise. Key to all these things, are the following interdisciplinary learning outcomes:

First, there is a need for researchers to be *ethnographic* in their approach. This has to do with being familiar with what to look for in terms of themes, topics, and issues, and in knowing how to explain or explicate aspects of the observed setting around these themes and topics.

Second, fieldwork is based, to some degree, on knowledge of prior fieldwork in order to produce an *analytic sensibility.*

Third, when fieldwork, and in particular, fieldwork-for-design is undertaken, the evidence it produces is of a *particular kind.* The way the fieldworker looks, what they look for, what they capture, all this and more, is wrapped up with their design motivation. Fieldworkers need to understand this ongoing relationship between data and design, though they may be quite distinct at various points in the process.

Fourth, the kind of materials produced by fieldwork enable or help create a *space for design thinking* – researchers need to understand the different forms these spaces can take and their particular affordances. The long written monograph is only one of these materials, others include graphical representations of the work in question, another is to undertake design workshops where the fieldworker or fieldwork team proffers examples, 'stories' about how they do the work, the development of 'patterns' and so on.

Fifth, fieldwork should be thought of as essentially a *collaborative affair*. This requires its own tools and processes to enable evaluation and testing of fieldwork understanding in ways that avoids the many pitfalls of the solitary ethnographer approach. By collaborative we mean that the evidence produced should be part of an overall process of team-based activities. These include collaborative evaluation and review and collaborative design thinking. The way the work is done and organised makes collaboration central.

Sixth, design-oriented fieldwork requires an *iterative* and dynamic approach to the role and position of fieldwork in the overall process. Fieldwork-in-design needs to be suffused with concerns from other stages in the overall process and though fieldwork may be mostly undertaken at the early stages of the process, it may be returned to later on as design iterations are made available for testing and evaluation.

This then is what we think fieldwork-in-design requires. It entails a hybrid of skills and tools from the 'ethnographic' and the 'fieldwork' tradition; it involves the use of a wide set of conceptual tools and concerns; and it requires a dynamic and flexible approach to its role in a design process. And finally, it requires a particular view about evidence, its evaluation and its use, and about the role of evidence generated by other disciplinary-specific approaches to fieldwork.

Tutorial Booklet: - aims and contents.

This is an updated, modified and highly abbreviated version of highly rated CSCW, OzCHI and ECSCW' tutorials developed and presented by Dave Randall. These notes, in particular are largely his work. This collection of notes in particular expands on and supplements the tutorial by attempting to develop an appreciation of the various theoretical perspectives utilised by CSCW practitioners and the practical issues that arise during the conduct of 'naturalistic' enquiry – perspectives that we will not be able to do justice to in the tutorial itself. A number of competing theoretical perspectives are examined, compared and contrasted. A range of perspectives including Glaser and Strauss's 'Grounded Theory'; 'Soft Systems'; Distributed Cognition; Ethnomethodology; Participative Design; 'business-led' perspectives such as Business Process Re-engineering; and Activity Theory are outlined.

The tutorial assesses competing claims concerning the relevance of the 'social setting' in which work takes place and the consequences for system development at

different stages of the system life-cycle, with special reference to problems of informing requirements and producing evaluations of, co-operative systems.

Particular emphasis is placed on complementarity of approach as manifested in contrasts between formal conceptions of process and notions of the 'accomplishment' of work; solution-driven and problem-driven conceptions of analysis; and on professional versus participative privileges in design.

Throughout, the tutorial stresses the development of a paradigm in the design of cooperative systems that relates the design of systems to the design of organizations. In particular, it attempts to specify the range of organizational knowledge that might be typically obtained from ethnographic study and in return relate our knowledge of work practices to the demand for new systems. It argues that the complexity of the organization demands an eclectic and evolving view of data and concept, and that the study of *socially organised cooperation* is central to new generations of systems in organizational contexts. That is, systems to support co-operative organizational activities often have a plethora of conflicting requirements, influenced, at least in part, by the social character of work in the domain.

The tutorial booklet attempts to meet a number of aims associated with the above objectives.

1. Participants will learn the relevance of theoretical perspectives to the practice of fieldwork, and to the problem of capturing social complexity.

2. The booklet emphasises the issue of analysis both as it relates to theoretical positions and in examining data /developing appropriate concepts

3. The practical problems, strategies and choices of the fieldworker in performing observational studies are discussed in detail. Experiences gleaned from a range of studies are offered for examination.

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Introduction

Supplementary notes

Computer Supported Cooperative Work (CSCW) has emerged as an identifiable research area which focuses on the role of the computer in the work of groups. The research being undertaken poses a number of questions: How can computers be exploited to maximise the synergy of groups? What kinds of software should be developed? How do we define and specify group work? To address these problems CSCW requires researchers from across a range of disciplines, not least those from the social sciences.

Various candidate perspectives have been deployed in search of answers to some fundamental questions, questions which arguably constitute a new paradigm for the understanding of system design and use. Notably, CSCW has brought to centre stage the notion that the design, use and evaluation of computer systems cannot be done without serious attention being given to organizational and work context. Indeed, it is not too radical to argue that that design of computer systems in a real sense is equivalent to the design of work and organization. (An insight that originates in socio-technical systems work; the 'job design' perspective from cognitive science; and participative design.) Nevertheless, the recognition of a new problematic is not the same thing as agreement about how to solve its problems. CSCW draws upon perspectives from a range of different disciplines in its examination of groups and computer support for group working. These include sociology, psychology, anthropology and organisational studies, in addition to the traditional complement of disciplines informing HCI. Further, like so many areas in which the social sciences are implicated, it contains any number of competing candidate approaches, theories, perspectives, and analytic strategies within each discipline. There seems little doubt that the successful and directed interchange and development of ideas across these different disciplines will be essential to the future of both CSCW and IT development in general.

Pressures for change in the Design Process

Structured design methodologies constituted something of a revolution when they first began to replace traditional systems design methods, and subsequently have held sway over the design and implementation of Information technologies in the commercial and industrial world for some time. That they have done so is hardly surprising. The need for accurate, shareable, and traceable information to be disseminated among large design teams; the orientation of design towards new rather than old ways of working; and risk avoidance among IT professionals are just some of the reasons for this. (We might point out here that many of these issues are just as important when it comes to integrating observational work into design) However, there are grounds for believing that the structured design revolutionaries, as it were, like others before them, have made the mistake of believing that their's would be the

last revolution in the field. In fact, critiques of structured design have become rather commonplace in the last few years, not least of course in CSCW, as other practitioners such as sociologists and psychologists have entered the design fray. In a nutshell, the social sciences have had much to say about the inadequacies of structured design. Much of CSCW research, particularly the sociological end of it, has concerned itself with the related issues of why it is that systems have not historically conferred the benefits expected (Grudin, 1991;1994), and less successfully what can be done about it. In recent years, ethnographic data has provided a wealth of evidence to suggest not only that I.T. systems are not only deemed to have failed in the purposes required of them, but that the reasons for that failure can be manifold and complex. These factors are sometimes glossed as having to do with 'organizational context'.

At the same time, the kind of critique offered by social scientists has tended to be somewhat academic and moreover particular to their interests as sociologists, psychologists, or what have you. It is becoming more apparent that there is another, and quite distinct pressure on design practice, associated much more strongly with the 'real world' of business. This is associated with the growing recognition that I.T. innovation does not and cannot take place for purely technical reasons, but must be oriented to organizational needs. There are, of course, senses in which this a mere truism, but it can be shown that important practical consequences emanate from it, not least in the shift from 'supply led' to 'demand led' I.T. strategies. (O'Brien, 1992). In short, and to quote Peppard, (1993):

" .... IS/IT decisions are too important for management to delegate completely (or indeed abdicate) to the IT professionals in the organization."

In part, this has been a result of the managerial response to the 'black hole' of technology into which large sums of money have historically been poured with varying results. Certainly, some important effects are now being felt from the very high levels of investment into computer systems during the 1980s:

1. Serious doubts have arisen about the purposes of this investment, despite the 'new paradigm' view. Various research claims have been made about the historical effects of IT innovation and its relation to productivity. At worst, it appears that some researchers doubt that innovation has had much, if any, positive effect on productivity, at least in some areas of automation.

2. There is increased concern with the measurement of the return on new systems, manifested for instance in a developing critique of Office Automation systems, wherein the difficulty of measuring the gains in efficiency and effectiveness associated with new technologies has been remarked upon by several commentators. (Vincent, 1990)

3. There is a desire to see system processes more accurately mapped on to organizational and work processes, perhaps most clearly seen in the burgeoning interest in managerial strategies such as Total Quality Management, Business Process Re-engineering and Workflow management. This has come about largely as a result of the level of competitiveness now found in the global marketplace.

Regardless, and to reiterate, the effect has been that management increasingly sees IT strategy as a central concern, and one which as a result removes decision making about IT from IT professionals and relocates it at the core of business strategy. The concern is nicely expressed by Bart O'Brien (1992), who quotes from Frederick Brooks' seminal book, "The Mythical Man Month", (in turn paraphrasing Shakespeare):

' "I can write programmes that control air traffic, intercept ballistic missiles, reconcile bank accounts, control production lines." To which the answer comes, "So can I, and so can any man, but do they work when you do write them?" '

O' Brien updates this telling remark in the following terms:

' "I can make strategies to transform your business, turn information into a management asset, incorporate IT into end products and services, and bring competitive advantage in the Information age". To which the response is, "Why so can I" .... '

He considers that IT strategies and implementations frequently disappoint, remarking that, " ... when the systems are finally operational at the price of tremendous effort, nothing very momentous seems to have been achieved at all." This is clearly, if true, of major import for systems design because the business- led strategies demanded to rectify these failures are very closely related to the analysis of requirements for new systems. The purpose of this tutorial might be summarised as attempting to describe and analyse the contribution ethnography can make to the design problem conceived of as a strategic approach to the design of organizations rather than technologies. As we shall see, many approaches to organizational change stress the importance of the monitoring and measurement of work. There is in our view, and we examine this below, an unwarranted assumption of 'scientific validation' contained within these approaches which ignores much of the reality of organizations and to which ethnography can be an important corrective. That is, the practical problems of 'doing' ethnography relate increasingly not only to understanding how it can contribute to the problem of 'requirements' for systems, but also to the strategic decision making that surrounds it. In this respect, it has an important role to play in the re- specification of the requirements process, if not of other stages of the design process.

CSCW, as we know, has already been instrumental in the awareness that requirements analysis cannot be considered a solely technical matter, but is fundamentally social as well. That is, it is always and inevitably a contested entreprise in which various stakeholders, with voices of varying 'loudness' according to the knowledge, power and influence they wield, will have often contradictory views concerning what kinds of systems intervention might be appropriate. What CSCW has hitherto less successfully contended with is that the synthesis that designers have hitherto achieved is likely to be driven more and more by business decisions to do with Cost, Profit, Customer Service, Efficiency, Effectiveness, and Turn-around time, to mention but some of the currently salient issues. Of course, these are no more than a set of objectives, albeit objectives which have a somewhat different provenance from those associated with CSCW. What matters, however, is that like it or not in a climate of global competitiveness they will impact profoundly on requirements analysis. Whether or not they will turn out to be effective means for establishing requirements remains to be seen. Ultimately the question is if and how these objectives are achievable.

As all systems analysts know, the job of analysis and specification is to produce a consistent set of requirements. That is, methods have to be found for reducing and removing ambiguity and conflict. This in a context where, as ethnographers have shown, the versions of what constitutes 'good' work and appropriate technology often vary across different occupational statuses, including for instance differences between managerial echelons, technical experts, and 'shop floor' workers. Indeed, various stakeholders can present different assessments even among individuals with the same status and role in an organization. Thus, in our own ATC study (see for example Bentley, 1992) the observation that, "if you ask twelve different Air Traffic Controllers for an opinion, you'll get thirteen different answers." was something of a commonplace among controllers. Indeed, the study also showed that there was a considerable tension between managerial pictures of appropriate technologies for future work practices and those of controllers and perhaps more importantly that no

group had particular confidence in the shape of the future of Air Traffic Control (see Twidale et al, 1994). There are some important issues contained in the stakeholder problem:

1.   At least one group of stakeholders, management, is both considerably more powerful than others in the organization, and likely to be defining strategy according to some theory of change. One consequence of this is that the managerial viewpoint will probably be extremely coherent and consensual.

2. Management is increasingly engaged in the business of explicitly planning the future by means of theories which are essentially rationalistic. This begs a whole series of questions, not least whether their objectives are in fact obtainable, whether selected means (which would include CSCW systems) are appropriate, and most importantly, how would you measure success or failure? Such questions will become more rather than less important as the tension between the 'professional' requirements work that IT specialists have historically undertaken comes up against the strategic decisions that organizational management will be taking.

3. Leaving aside the ethical issues contained in designing organizations, are the interests of other stakeholders important in other respects? For instance, what importance do we attach to the notion of 'the user'? There is, for instance, a world of difference between the objective of designing the User Interface so that it supports necessary skill and expertise among groups at work, and of designing the whole system to support the way groups of user like to work (and just to complicate the issue, although these are quite divergent objectives we cannot be sure they do not relate to each other!). Equally, what are we to make of the radically divergent opinion? In the normal course of events, few would attach much importance to the views of the maverick, but in Safety Critical Systems such 'whistle blowers' have a habit of highlighting significant failings.

4. How do we know whether these objectives, once decided, will be, or have been, successful or not? That is, what will the measures of success or failure be, and how will they be determined? This, again, is becoming an ever more important issue at least in part because organizational change strategies are very concerned with the problem of measurement. It would suggest that the evaluation of systems in work is likely to take on a greater significance.

We cannot ignore these different 'takes' on technology and the organization in CSCW. CSCW systems have often been, until relatively recently, of a prototypical nature, often existing only within research labs. Many of these systems address the problems associated with supporting limited groups of people often engaged in artificial tasks. Market penetration and user acceptance of CSCW system has not been as high as researchers expected (Grudin, 1988; Markus and Connolly, 1990). A significant reason for this failure is the inability of most such systems to support those features central to work within 'real world' organisations. Sensitivity to the inadequacies of these systems for the needs of their real world environments, together with changing ideas about the character of work and the role of technology in it, has seen a re-conceptualisation of design for CSCW systems and the emergence of novel techniques to enable their development.

Development of CSCW systems by necessity involves a greater reliance on meeting 'users' needs and upon information obtained through the study of the setting for which the system is being designed. Most IT systems are normally developed in the context of a laboratory or a software house to be applied within a real world context and work setting. Developers are unaware or have only a partial knowledge of this setting through a set of requirements extracted by systems analysis at the start of the design. This results in a mismatch between the design and development process and the features of the work setting in which the system is intended to be used.

This mismatch is a central problem in the design of CSCW systems which need to provide support adequate to the socially situated features of user activities. An approach increasingly being taken by CSCW system developers is to use observational studies and/or user participation throughout the design process to minimise this mismatch. This allows a more effective bridge between the system's design and development process and the work setting in which it is to be used. This tutorial, then, will discuss the various perspectives on work and organizational context that are commonplace in CSCW research with the specific intention of relating them to the practice of fieldwork, and especially the kind of fieldwork normally glossed as 'ethnography'. The aim is to provide a working knowledge of the use of ethnography and its relationship with the theories which inform systems development. The tutorial deals with two broad and interrelated issues:

The theoretical auspices of data collection.

The role of requirements capture in systems development is a very important one, as the products of this exercise traditionally drive the rest of the process. Our interest here lies primarily in the way in which claims to ownership of the requirements capture process are being made by some wide ranging interests, including on the one hand those with an interest in the 'social' and on the other those with a stake in systematic change management. What is often understated is the way in which theoretical and analytic choices link in with the way we collect and 'see' data. Data, as sociologists are wont to argue, ad nauseam, is 'theoretically laden'. Therefore, in principle, the theoretical devices chosen to formulate research questions, and to organize results, matters.

Methods for social investigation: practical issues

Of course, along with theoretical choice, actually deciding how to go about the business of conducting fieldwork- the practical business- is equally important. This section will attempt to 'point to' some known problems and some ways of dealing with them. We should stress here that we are not trying to provide a programmatic account. We do not believe in the 'one best way', but recognise that there are some very bad ways. Problems and techniques for performing 'good' ethnography, then, will be highlighted, but not with a view to proselytising. The nature of ethnographic data will be presented by way of data produced by real ethnographic studies.

 We will draw heavily on the practical experiences of the authors in ethnographic
work undertaken in commercial and academic contexts, outlining lessons learned from that experience and conclusions to be drawn in relation to approaches to change management. In particular, several examples are given from data which has been collected under the auspices of the SYCOMT project, a research project being undertaken under the auspices of the Department of Trade and Industry CSCW initiative, and involving a partnership between the Digital Equipment Company, Lancaster University, SYNCHO Ltd, and partners in the retail financial services sector. Most of the data we use is taken either from a series of observational studies in a variety of retail financial service companies, or from the Air Traffic Control studies also conducted at Lancaster University.

The theoretical background- choices to be made.

Supplementary notes

Our aim in this section is to provide a relatively brief explanation of the underpinnings of some popular and well-known, at least by name, approaches to the study of work. We do not attempt to choose between them, and hope that our portrayal of them is principled and 'objective'. Equally, we cannot provide, for reasons of space, the same degree of thoroughness for all perspectives and indeed all the issues we examine. We have provided some indication of further reading in each case if people wish to pursue any particular perspective.

Participative Design (P.D.)

Although it is slightly unfair, P.D. has always been associated with Scandinavia, and is sometimes called the Scandinavian movement. This is unfair for at least two reasons:

1. There is a great deal of P.D. work going on now in the U.S.A. and much of its original impetus came from the socio-technical systems work of Mumford in Manchester, England.

2. There is no single 'P.D.' movement. The term is a gloss, and covers many different practises, as we shall see. Bansler, for instance, writes,

'I would like to stress that there is no such thing as the Scandinavian approach. There is not one, but several Scandinavian approaches to system development, including the Collective Resources approach and various Socio-technical approaches. These approaches differ with regard to their basic goals and ideological foundations as well as their development strategies and design methods.'

Nevertheless, as Nielson and Relsted point out, "Participation is expected in Scandinavia. Far from being an ideology, it has become the normal way of doing development and implementation work ... in many cases actual participation exceeds formal rights." This would seem to suggest that P.D. has a natural 'fit' with Scandinavian social democracy, since such a claim in the context of, for instance, the U.K. would be absurd.

P.D. can be said to have certain characteristics, although their balance will alter depending on specific stance.

1. A broad concern with the politics of design. It has been remarked in several studies that one of the fundamental problems with systems implementation is resistance to change. That is, users confronted with new and potentially invasive systems find ways

of preventing them from working. Resistance, in other words, is seen as a political problem that can be overcome through involvement. Thus, researchers like Sandberg (1975) distinguished between Conflict and Harmony based approaches to design, and the approach was taken up by trade unions as a means to resolve conflicts.

2. Support for some notion of user participation. This may seem axiomatic, but there is much variation on the basis of what kind of participation is implied.

3. P.D. has been, at least in the past, action- research oriented rather than theory driven. Early studies tend to be reflective accounts of 'what was achieved' and 'what was not'.

Theoretical development.

socio-technical systems theory

P.D. owes much to socio-technical systems theory. Thus, issues like how to design jobs, using notions of job satisfaction, are central to the design of systems in the P.D. view. Concepts such as knowledge fit; psychological fit; efficiency fit; task structure fit; and ethical fit (Mumford, 1983) have all been recognised as relating to the effectiveness of systems. Nevertheless, this psychologistic viewpoint sees users both individualistically, and tends to treat them only as sources of information for the designer. That is, although we may regard 'job design' as a step forward, it is still designers who design jobs.

This has been developed in that users in P.D. are recognised as being rather more complex than Mumford's type of analysis would have it. Thus,

"*By viewing the people who use computers as competent in their field of work, we find that the workplace takes on the appearance of a rich tapestry, deeply woven with much intricacy and skill ... [there is a need to] ... take work practce seriosly.*

[recognise] ... we are dealing with human actors, not cut and dried human factors.

[recognise] ... work tasks must be seen in their context, and are therefore situated actions.

[recognise] ... work is fundamentally social, involving extensive co-operation and communication.

(Greenbaum and Kyng, 1991)

That is, the culture and work practices of people are seen as deeply relevant to design. In this respect, P.D. is a core strategy in CSCW related work, since articulating this culture and practices is the problem. A variety of conceptual tools have been used in this phase of P.D., not least the 'job design' philosophies associated with HCI.

the general argument for this variety of P.D. is;

1. It improves the knowledge base on which systems design is based,

2. It enables people (users) to develop realistic expectations, and thus reduces resistance to change.

3. It increases workplace democracy by giving individuals the right to participate.

The Collective Resources approach.

This approach, associated with the work of Ehn, Kyng, Bodker, Bjerknes and Bratteteig, Greenbaum and others, is the strand of P.D. that relates most closely to the kinds of political claim associated with P.D. it is sometimes also called Work-Oriented Design, or 'critical' design.

CRA can be viewed as a more radical alternative. In particular, the criticism was that socio-technical systems was merely a means to integrate behavioural aspects (ie work) into the design process, but that it didn't take into account other aspects of the organisation, not least the existence of power structures. Thus, Nurminen argues, "... [early PD work] never documented radically new system concepts, perhaps due to the local scope of the projects and the action research character. PD is a (skew) concept because it tells, for example, that participation is something extra .... thus the design process essentially takes place somewhere else by someone else."

Hence, the Collective Resources approach, associated in the first instance with the UTOPIA project, involved attempts to promote democracy at work. That this, it treated the organisation as a normative structure, and the technical systems as part of this normative structure. UTOPIA was regarded as 'different' because it was larger in scale, and more importantly, because it treated the technical system as a tool for accomplishing other objectives. There can be little doubt that in Information Systems terms, P.D. was the first approach which stressed the importance of 'real world' settings, rather than laboratory work. UTOPIA lasted from 1981 to 1984, and was a research project which involved universities and the Nordic Graphical Union. The idea was to develop technologies for graphical workers that retained their skills, resulted in high quality product, and allowed a democratic form of work organisation (Hardly incidental that a Trade Union was involved, although those familiar with union politics might be forgiven a brief snort of laughter over the notion of democracy.)

In fact, UTOPIA used some fairly traditional approaches to requirements capture to begin with, but quickly moved towards a 'mock up' approach which is consistent with what has subsequently become called Rapid Prototyping. This approach became called 'design by doing' and traded on the idea that watching workers doing work, even in simulation, was better than orthodox knowledge elicitation. a 'Tool perspective' was developed during the course of this project, which is predicated on the view that the computer is a tool for the skilled worker.

Other projects using P.D. have included FLORENCE. Florence (1984-1987) was a project aimed towards the work of nurses. it was predicated on the principle that medical support systems tended to be supply- led, and that knowledge of nurses work might rectify this. Florence was intended to be a system to support nurses daily work, based on their language and skills. It involved two hospital wards. other groups, notably doctors, were included in the design team as well. They concluded,

1. That a computer system of this kind was possible, and the prototype was in fact put into use.

2. The design of the organisation and the physical space were critical to success or failure.

However, the main benefit of the research was its emphasis on 'mutual learning'. That is, it emphasised communication between professionals and designers as a critical factor, and analysed the pathways by which knowledge of each other's concerns was established. They acknowledged at least one weakness, what they called the 'harmony' perspective, or the 'one party' perspective. In other words, they tended to ignore conflicts and inconsistencies. In this respect, Florence was rather different than most

collective resources work, which takes an explicitly conflict based perspective, and takes a side in the conflict.

PD has the merit of raising a host of issues concerning 'users'.

A. Which users?

Bjerknes and Bratteteig, for instance have argued that not only the immediate workplace is important in terms of users' input, but also much wider communities of user might be relevant, including the organisation as a whole, inter- organisational features, and even a societal level (!)

B. When? There seems to be a natural 'fit' between PD and rapid prototyping, in that several studies have reported on the problem of of maintaining user involvement at various points of a more traditional 'system life cycle'.

C. To do what?

1. Should they be involved in specifying the interface?

2. Should they be involved in specifying the system? Should users be involved in the design of primary functions? ie. Should they help re-design what they do, with or without system support?

3. Should they be involved in the design of organisational features? The jobs of users are often task specific and they may have difficulty relating the system requirements to other people's functions.

4. What relationship should be presumed between users, management and developers? Some studies have raised a problem in that developers may stick to old practices, and even when there is sensitivity to user involvement, management can intervene at any stage.

See Hales, 1993, for a review of some of these issues as they occurred in one case study.

P.D. relates to the practice of fieldwork in some interesting ways. In early work, it rather implied that fieldwork of the type associated with ethnography would not be necessary, in that evolving 'good practice' would appear to obviate the need for rigorous observation. Latterly, however, various P.D. projects have moved to incorporate some element of fieldwork. Simonsen and Kensing for instance, suggest that their motivation in taking an ethnographic stance along with more orthodox P.D. strategies was based on two relevant features of the design process:

1. Users often don't get what (they thought) they asked for.

2. There is a need for a more flexible approach to system design.

They further imply that one source of complication, and one which ethnography may be well suited to deal with was organizational complexity. In their study, this was manifested as

a. Significantly different pictures of relevance across editors and secretaries. For the secretaries the cycle started when a funding decision was made; for the editor the main work took place long before this point. At least one editor took almost no part in production after he had made the decision, and more or less left it to his secretary. The new system thus had to support this decision making work as well as everything that followed.

b. It was recognised that some aspects of the decision making process were regarded as confidential and thus that documents pertaining to it could not be 'open'.

c. They discovered that the reason for this confidentiality was a power struggle between editors and the production manager. Editors are not skilled in, or interested in, economic factors, but the production manager is (that's the job). The production manager has to ensure budgets are kept to, and there were thus sometimes tensions. The point they make was that designing a new system intervened in these tensions, and thus became a political process.

Activity theory

Activity theory originates in the humanistic psychology of Vygotsky. As such, it should be understood both as a critique of the simplistic 'behavioural' tendency in psychology, and an explicitly 'humanistic' programme (it is largely forgotten that Vygotsky's agenda was in part a political one). For Vygotsky, psychology should emphasise at least three primary elements:

1. It should be developmental

2. It had to relate 'elementary' psychological functions with 'higher level' mental work, and

3. It had to take account of 'socially meaningful activity'.

Vygotsky was particularly interested in methodological issues, noting even at that early time that facts were 'theoretically laden'. Hence:

 "Any fact, being expressed in terms of these systems [introspectionism, behaviourism and psychoanalysis} would acquire three entirely different meanings, which indicate three different aspects of this fact, or more precisely, three different facts." (Vygotsky, 1982)

In part because of this, psychological investigation must be 'layered'. It cannot restrict itself to basic functions such as attention, memory, etc., but must also be aware of the 'inner evolution' of psychological formations. In a nutshell, this refers to the development of concepts.

An initial finding was that thought and speech are not synonymous, and have different origins (This, remember, many years before Sapir-Whorf). They merge at particular moments. In particular, they merge at the level of 'higher' mental functions- functions which form an existence *culturally*. In certain contexts, then, thinking about matters, and we may impute from subsequent and more modern work, thinking about technology can be *preconceptual*. (sometimes referred to as spontaneous concepts- located entirely in reflection on immediate experience, and distinguished from scientific concepts) This has an immediate corollary in *learning*, in that this also can be systematically organised or spontaneous.

The best known concept to emerge from this approach is that of 'zo-ped', or the 'zone of proximal development'. In effect, it refers to the pre-scientific world of spontaneous concepts inhabited by children meeting the systematic, organized world of the rational adult. Of course, it can equally well refer to the way in which the 'tyro' user meets the expert. The point is that this meeting place is a rich learning experience- the learner learns by transforming the one into the other in and through the dailogue between learner and expert. In essence, then, activity theory orients to

three elements; Actor, Object and Community. Its richness for CSCW lies in principle in its approach to technology as mediator of human activity, and in a dialectic relationship with the cultural world produces activity.

It is not entirely surprising, given this interest in concept formation that Activity theory has been of powerful interest in fields such as Computer Supported Cooperative Learning (CSCL) and to some degree in CSCW itself. (See Kuuti, 1994; Bardram, 1997)

In terms of analytic stance, activity theory is at best neutral on the business process, or managerial perspectives in general.

Vygotsky was originally subject to criticism for the naivety of his experimental work and the loose coupling of data to theory. Arguably, activity theory remains methodologically underspecified, although Bardram in particular (1997) makes some progress with this in his study of a patient scheduling system.

Grounded Theory- Glaser and Strauss

We include Glaser and Strauss (1967) here because a few practitioners have founded fieldwork on their insights. Their ideas grew out of the 'Chicago' school of sociological research, and developed many of the arguments produced by the symbolic interactionists in their 'grounded theory'.

They were concerned with the way quantitative techniques involve forcing data to 'fit' pre-organised categories and argue further that this actually prevents the researcher from refining theory. For them, adequate theory can only be developed by systematic investigation of the real world. Grounded theory is inductive, (unlike the deductive methods of the positivist) and relies on moving from the particular to the general.

Methodologically, it means that the structure of research cannot be specified before you actually start doing the research. You cannot determine in advance who needs to be studied, how to study them, and what 'correct' evidence will be. It further means that the standards of evidence (what counts as evidence) need to be relaxed. Their standard is 'plausibility'. In this respect, their conclusions have something in common with ethnomethodological presuppositions, as we shall see below.

They offer two main techniques for grounded theorizing. The first is the '**constant comparative method**.' This is a method for generating categories, or concepts. Categories in turn have properties. They use their studies of nursing care for the dying to illustrate this. They give two categories of nursing care- 'professional composure' and 'perception of social loss' (meaning their perception of what the loss of a loved one will mean to relatives and friends). A property of the latter is 'loss rationales', whereby nurses decide how to explain the death of a patient to others when the death involves a high social loss (matters to people). These loss rationales help them maintain their professional composure.

What they do is look at examples of things that look to be similar from the point of view of the analyst. (lots of examples of nurses dealing with the death of patients), and derive some categories which make sense of what they see. The point is that at some point in the research the categories you have developed can guide you to what to look for- something that you cannot do at the start of your research. Analysis should continue only so far as it helps develop new categories or properties. This argument has been very influential in sociology, and we can see its relevance to CSCW. Firstly,

it clearly implies that fieldwork is an 'evolving affair', and its function is substantially to allow the analyst to produce reasonable categories with which to describe 'what is going on'.

The second technique is '**theoretical sampling'.** By this they mean that you choose your cases to best serve the theory you are developing. Unlike positivist research, where a population has been defined before you start, with theoretical sampling your choice of who to study (your cases) depends on the theory you are developing. (This doesn't mean ignoring cases that don't fit your early theory- it means emphasising cases that are relevant to your early theory).

They give examples from deciding what to study in the nursing business-

"Visits to the various medical services were scheduled as follows: I wished to look at services that minimised patient awareness (and so I first looked at a premature baby service and then at a neurological service where patients were frequently comatose.) I wished next to look at dying in a situation where expectancy of staff and often of patients was great and dying was quick, so I observed on an Intensive Care Unit. Then I wished to observe on a service where staff expectations of terminality were great but the patient's might or might not be, and where dying tended to be slow. So I looked next at a cancer service. I wished then to look at conditions where death was unexpected and rapid, and so looked at an emergency service."

".... So our scheduling of different types of service was directed by a general conceptual scheme- which included hypotheses about awareness, expectedness and rate of dying."

By this process, a conceptual scheme develops which becomes progressively more abstract. They distinguish between substantive theory, which comes directly from the data, and formal theory which is more abstract and general. **Formal theories cannot be applied to new areas of research**. Rather, substantive theories must be developed, and formal theories selected from according to relevance.

Examples of their influence include the work of Fitzgerald et al (1996) in their study of the work of system administrators, and Becky Grinter, who has used insights from Glaser and Strauss in her study of the development of a Workflow System (1997)

Ethnomethodology

We cannot cover the whole of the literature on ethnomethodology, for it is vast, but try to bring out some of its fundamental features, in particular, its interest in language, in 'context, and in the notion of 'accomplishment'. Ethnomethodology is generally held to have originated with the work of two Californian sociologists, Harold Garfinkel and Harvey Sacks, in the 1960s. In fact, its origins can be traced back to what is usually called phenomenological philosophy, and to Alfred Schutz. One aspect of the ethnomethodological programme that tends to be lost in CSCW (and it is probably just as well) is the radical nature of its relationship to other disciplines such as sociology and psychology. Its stance on problems such as 'meaning', 'cognition', and 'behaviour' is both methodologically at variance with standard disciplinary assumptions, and perspectively distinct. In a nutshell, ethnomethodologists (to a greater or lesser extent) would argue that most disciplines confuse

theoretical with practical matters, and are imbued with dubious philosophical commitments of one kind or another. That is, ethnomethodology refuses any epistemological or ontological commitments, and limits its enquiry rigorously to what is directly observable and what can be plausibly inferred from observation on a known-in-common basis. (compare this with foundational assumptions in cognitive science, which have to do with inference about mental 'structures' or 'states')

Another way of phrasing these different commitments is in terms of, on the one hand, theoretical concerns with what can be objectively known- a scientific worldview, if you will, and evolving from the rationalism of Kant and Descartes in the 17th century, who had as their topic of enquiry what can be known and how it can be known. That is, they were concerned with the construction of an epistemology. Just by way of example, the work on the logic of mathematics associated with Bertrand Russell, and work on the nature of sensory inputs associated with some cognitive psychologists are examples of this kind of perspective. In contrast, the phenomenologists rejected the notion that it is possible to know an objective reality derived from logic or from the senses. Rather, they were concerned with the prospect that what we know is inevitably constructed from our experience. This experience may be made up of many things, but for instance always includes the concepts we use and the words we deploy. The phenomenologists started from what is called the '**natural attitude**', which refers to the way we mundanely, ordinarily, without any problems, see the world as made up in a particular way. The point is that the natural attitude contains no doubt about the way the world is, whereas philosophy and psychology are based on doubt concerning it. Rather than doubting whether the world is 'real', the phenomenologists were interested in analysing the natural attitude, if you like in understanding what it is like to experience the world the way we experience it, and suspending any beliefs concerning whether it is 'really' like that. (Indeed, and subsequently, not only Schutz but others as well, pointed out that even science depends on pre- interpretation. In other words, all thinking activities, whether scientific (and thus supposedly objective) or common- sensical, rely on our known in common views of the world -(intersubjectivity as distinct from subjectivity).

This means if we are to interpret social behaviours, we can't just look at them, since we have to impute some motive, desire, rationale, or whatever, to the actions in order to explain them. Thjis, in effect is what Garfinkel meant by the Documentary method. This is a really important point, since it means that common- sense is at least in part how we always interpret the world, and just as importantly, it is largely unproblematic. We don't for the most part have any trouble interpreting the world.

Some initial relevance to CSCW concerns can be identified in Schutz, as the typifications of actors- their stocks of knowledge about the world- include knowledge about,

a. Objects

b. Recipes (how to do it knowledge, rather than a general rationality)

These stocks of knowledge are contingently valid- that is, they are treated as right until something crops up which makes them problematic. Moreover, stocks of knowledge are not normally consulted, we simply take them for granted.

No two people can have identical viewpoints, but we can behave, again without problems for the most part, as if we do. Intersubjectivity relies on two fundamental assumptions on the part of actors which are part of a general Reciprocity of Perspectives. We assume, until it is proven otherwise,

1. that if we stand in the place of the other person we will see and think about things in much the same way as we see and think about them now. We will share, that is, typifications.

2. that, although our personal biographies make us different, we are sharing a common perspective on the world when we interact. That is we are selecting shared and common objects and features to talk about.

Just as importantly, there is no guarantee of this shared world, it is actively sustained by participants to it.

This is ethnomethodology's starting point:

How do we achieve and sustain this known in common, typical, world as a matter of ordinary, practical, purpose?

Returning to Garfinkel and Sacks, then, the fundamental problem is how people maintain orderly conduct- how they produce order in and through their intersubjective action. Garfinkel elaborated the 'Documentary Method of Interpretation', mentioned above, which refers to the way in which we treat appearances as standing as the 'document' of, or pointing to, an underlying pattern of meaning or intention.

For our purposes, two main strands of ethnomethodological enquiry have been influential in CSCW:

Ethnomethodological Studies of Work

This approach, emphasised by the Lancaster school in the U.K., and by the work of Suchman etc. At Xerox Parc, and by the likes of Richard Harper and Graham Button in Europe, was developed substantially by Garkinkel, Lynch and Livingstone. It is predicated on what Garfinkel termed the 'missing what' of most sociological enquiry into work. That is, the sociology of work, much though it might have contributed, tells us little about the nature of work itself- the nature of work as moment-by-moment 'lived experience'.

In contrast, the ethnomethodological studies of work programme takes as its **only** topic, how members accomplish their work tasks. The stress is important, for it implies no commitments of any kind as to the merits or otherwise of members' world views, attitudes, assumptions and so on. hence:

a. Most sociology investigates the social world from a set of prior categories, eg. Conflict; Class; Gender; Control and so on. In contrast ethnomethodology is interested in the 'common sense' categories that members themselves deploy.

b. Ethnomethodology brackets ontology. That is, *it is not interested in the truth of members' claims*, but in how they arrive at those claims. That is, it treats accounts as versions.

c. Ethnomethodology is not interested in the fact that the social world is ordered but in how it becomes ordered in and through the processes of interaction. The focus of ethnomethodological work is thus processual in a very specific sense. In a nutshell, *it treats all social situations as the accomplishment of members*. In the context of work, *it focuses on how people actually order their working activities through mutual attentiveness to what has to be done*.

That is, and put simply, ethnomethodology means people's methods. It involves seeing things from the point of view of participants and trying to understand how their 'form of life' can be construed as the outcome and accomplishment of their interactions. Taken together, these points indicate what an ethnomethodologically informed ethnography would look like. They suggest it would be an analysis which is interested in how people conduct working life in real settings, doing what they do in

the mutual accomplishment of sometimes divergent intentions, treating work as socially organised and interested above all in *how* it is socially organised in that setting. This means looking at the actual working division of labour as routinely manifested in peoples' meaningful orientation to their work, not an idealised conception of it such as that which might be associated with T.A. or process modelling. One important feature of this is that it would not treat work and technology as analytically separable. It would treat technology as technology-in-use.

The task is merely to report in adequate detail how they go about doing what they construe as the thing to be done. The relationship between ethnomethodology and design, then, on the face of it looks slightly puzzling, since design must be about commitments.

There have been a range of responses to this, from:

'we just provide the data- leave the rest to designers'

to:

'start 'innocent', become 'informed''

In either version, ethnomethodology does not and cannot do any strategic work.

Conversation Analysis.

C.A. has been a major entreprise within ethnomethodology for many years. There are many examples, including the work of, for brief mention, Schegloff, Jefferson, Pollner, Drew, Heritage, Atkinson, and many others. It has taken a number of directions in this time, including for instance attempts to formulate conversation as manifesting gender inequalities (Dorothy Smith) and power structures (Atkinson and Drew). It is not the place here to enter into debates about whether these attempts make sense or not. Rather, our emphasis will be on the notion of rule following, largely because at the core of C.A. is **the proposition that conversation can be said to embody a set of rules**.

Now we do not need to go into any great detail here, but we can identify some of these basic rules that the C.A. people are interested in as (and these are only examples):

1. At least and not more than one person talks at a time, and any overlaps will not persist.

2. All conversations are structured in terms of adjacency pairs (first part- second part) with the first part spoken by one person and the second part spoken by another.

3. The second part will be relevant to the first part.

4. Turn taking is allocated with a minimum of gap or overlap. Sometimes 'speaker selects' methods might be used- eg. 'what do you think, Paul?', and sometimes 'self select' techniques might be used (pauses).

5. There are particular structures to the opening of conversations. These include summons/answer; identification/recognition/; greeting/greeting

6. There are particular structures to the closure of conversations.

Perhaps more importantly than this, CA work has focused on the way in which Conversation can be repaired. That is, a normal feature of conversation is misunderstanding, but what is

clear from real conversation is that we normally recognise our mistakes and correct them in the course of the exchange.

In turn, this has led to a focus on Conversation Analysis as a resource for solving some problems associated with cooperative work. Examples of work in this area include ethnomethodological work such as Frohlich and Luff's 'advice system', Heath and Luff's seminal study of the London Underground and Gilbert, Wooffit and Fraser's 'Sundial' project. In a nutshell, the insights afforded by this perspective include

1. The idea that we can uncover a 'grammar' of communicative acts, which would include gesture, gaze, etc., (thereby, in principle, providing a logic of enquiry for all similar work) and

2. That a focus on the detail of communication work has specific resonance for design, through its recognition of the semi- tacit nature of some communication.

There is some debate among ethnomethodologists about the degree to which C.A. constitutes a general rule-based understanding of communication. The fact that there are rules which can describe some aspects of conversation does not mean that conversation can be described strictly or always in terms of rule following behaviour.

Firstly, what is meant by 'rule'?

Is a rule something which provides a causal relationship? Well, it might be, but it doesn't have to be. One way of looking at the 'rules' of conversation would be to view them causally, and if you can, then the sophisticated simulation of conversation is only a matter of uncovering every rule and its relevance. In principle, this may be no easy task, given that there may turn out to be a huge number of rules, but few would argue that the number of 'conversation generating' rules is that large.

The kinds of ways in which natural language systems use this analysis include Frohlich and Luff's advice system, which is designed to preclude or prevent certain kinds of response. Thus, if the system asks a question, users are forced into conditional relevance by giving answers to questions. The 'Sundial' project, designed for airline bookings and enquiries has a similar structure, by including identifiable adjacency pairs, turn taking mechanisms, opening sequences, closing sequences and question/answer structures.

Distributed Cognition

'Cognition is a fundamentally cultural process'- Hutchins

Distributed Cognition is a relatively recent theoretical resource for CSCW investigation, and owes much to the work of Ed Hutchins. Other well-known proponents of this perspective include Yvonne Rogers and Christine Halvorsen.

Distributed Cognition starts from the perspective that cognition and culture are two parts of a larger system. Its great insight is that cognitive processes take place both inside and outside of the head. To put it another way cognition and culture are intimately connected.

For Hutchins, the marginalisation of culture by cognitive science has had reductionist effects, and has led to ignorance of context, or 'situatedness'.

Hence, "The early researchers in cognitive science placed a bet that the modularity of human cognition would be such that culture, context, and history could be safely

ignored at the outset, and then integrated later. The bet did not pay off. These things are fundamental aspects of human cognition and cannot be comfortably integrated into a perspective that privileges abstract properties of individual minds." (Hutchins, 1995, p354)

The second significant feature of this perspectival insistence is that it places too much emphasis on the 'boundaries', and hence mistakes the properties of the system for those of the individual. Thus, he argues that this mistake can be seen in the assumption of 'primitive minds' in technologically primitive cultures. (One should point out here that this is something of a 'straw man' argument in that various anthropologists have critiqued the notion of the 'primitive mind' over a long period of time.)

Moreover, and equally important, 'culture' is a great deal more than typical anthropological accounts would have it (at least according to Hutchins) in that culture is material. Distributed cognition makes much of the idea that 'we cannot know what the task is until we know what the tools are' (p114) In other words, understanding task is a matter of understanding human activity in an environment- an environment which contains physical artefacts which themselves are culurally evolved.

Hence,

1. Distributed Cognition relies on the notion of,

"a complex functional system consisting of many media in simultaneous coordination." (p288)

2. Sees systems as having both computational and social properties.

3. Sees learning as "adaptive reorganization in a complex system" (p289)

Taken together, we begin to see what the task of the analyst might be. The system is a material environment which can take a symbolic form, according to the kinds of media used to make representations of it. We need, therefore, to understand the nature of the system in its widest sense, and the various conditions and artefacts that make it up.

These media have to be coordinated, and human beings, using their social experiences- knowledge, skill, expertise, etc- work out ways of doing exactly that. (These ways get internalised and then become cognitive matters)

The benefits of distributed cognition for Hutchins are clear:

"Among the benefits of cognitive ethnography for cognitive science is the refinement of a functional specification for the human cognitive system. What is a mind for? How confident are we that our intuitions about the cognitive nature of tasks we do on a daily basis are correct? It is a common piece of common sense that we know what those tasks are because we are human and because we engage in them daily. But I believe this is not true. In spite of the fact that we engage in cognitive activities every day, our folk and professional models of cognitive performance do not match when cognition in the world is examined carefully." (P 371)

Thus, for those who see cognition as a fundamental part of understanding human experience, and who recognise that attention to 'group' behaviour is a matter of understanding 'context', distributed cognition provides a way of integrating two historically contrasting perspectives in cognitive science and social anthropology.

Distributed Cognition has been criticised for 'colonising' other approaches, notably ethnomethodological studies of work. It is certainly true that the notion that cognition is social is hardly original. Nevertheless, what its defenders would argue is that by retaining a conception of 'cognition in the head' it provides a means for relating 'mental' processes to cultural processes. There is some ambiguity in our view in the literature about the nature of this relationship, but if our position on it is accurate, it constitutes the main point of departure from ethnomethodological studies, in that ethnos for the most part would have little interest in what goes on 'in the head', following Garfinkel's formulation that 'there is nothing in the head except brains'.

Soft systems analysis.

Checkland and Scholes work has attained some importance in recent years in the European context. It grew out of, as Checkland and Scholes make clear, the inability of Systems Modelling tools to cope with what they call 'messy, complex problems'.

Stemming from criticisms of Operations Research, which suggested that formal models of decision making ignored its complexity, it explicitly tries to retain systems thinking, but develop it by providing tools for understanding it, and especially 'viewpoints'.

It was NOT in origin a method for aiding the design of computer systems, although it has been increasingly treated as such in a number of evolutions since then.

Background- Systems theory.

The defining quality of a system is that when treated as a whole it has different qualities than one could deduce from the individual parts. Systems theory essentially is HOLISTIC. That is, it treats the system as a structure which has properties quite distinct from those of its parts. (ie It is more than the sum of its parts) It draws heavily on analogies with the body. Systems have certain characteristics:

1. Systems have one unique property, that of EMERGENCE. This means that the properties of the system only emerge when the system is viewed as a whole.

2. Systems are hierarchies- they have levels. Any system can be conceived of as having a set of sub-systems (which are also systems in their own right)

3. Communication and Control. Systems cannot function without the interactions of the parts. Therefore, there must be forms of communication and control which enable this. *These communication/ control elements can be understood as the inputs and outputs to and from the parts*.

Checkland produces a formal systems model which suggests that systems must always satisfy certain criteria. They are:

a. Systems have purposes.

b. There are measures of performance by which we can judge whether systems are effective or efficient.

c. There is always some mechanism for control or regulation.

d. Systems have components which are themselves systems

e. System components must interact.

f. Systems exist as part of wider systems (the environment)

g. Systems have boundaries, defined by the limits of the regulating mechanism.

h. Systems have resources, controlled by the regulating mechanism.

i. Systems are durable. They can be disturbed, but are resilient.

Soft systems theory is geared towards the analysis of particular kinds of system, called HUMAN ACTIVITY SYSTEMS, which are OPEN systems. That is, human activity systems are always interacting extensively with their environment. Human activity systems are complicated by the fact that they can be viewed in many ways, and are so viewed by the participants. In a nutshell, systems, and human activity systems in particular, are extraordinarily complex. Analysing systems from a Soft Systems point of view is done with the intention of both understanding and of reducing complexity.

Basic Assumptions.

Organized Purposeful Action.

SSM starts from the notion that human behaviour is interpretative behaviour. This means that people ascribe meaning to action and the situations they find themselves in. In this respect, SSM draws on some of the assumptions contained in Interpretative sociologies such as Symbolic Interaction, and, latterly, Goffman's work, although this could hardly be described as central to its purposes.

It is distinct from them in that it contains a highly specific view of what meaning is and how it operates. That view can be described as fundamentally Rationalist. It treats meaning as mainly being to do with INTENTION. It defines purposeful action in terms of intentions based on knowledge. It points out that 'scientific' knowledge, by virtue of its precision and the replicability of its experiments, allows for a level of certainty that the human sciences cannot aspire to. (Note that a criticism of Checkland is the naivety of his view of science, but this has little bearing on the practical consequences of his work)

Basically, they want to suggest that management science relies on a model of action which is iterative. That is, intentions are based on knowledge, but action creates new knowledge, or experience, which in turn creates new intentions. In other words, LEARNING is central to the issues at the heart of management.

It further argues that to be useful, any theory of organizational learning should be a 'formal' theory. That is, it should contain a set of rigorously defined concepts which explicit relationships. Unsurprisingly, given the background of these writers, that theoretical perspective is systems thinking.

The unit of analysis, then, is purposeful activity. This can be described in terms of A being a person who takes a purposeful action, which will have an effect on B,C,D, etc. These actions, however, do not take place in a vacuum. They are CONSTRAINED by the environment in which they take place.

Building up simple models of this kind (human activity systems) allows us, in Checkland's view, to get to grips ultimately with 'real world' situations.

They see their method as being designed to address a flaw in engineering methods. That is, engineering is a 'how to' or 'constructive' discipline in which the task is to move from a statement of purpose (or requirments) through to a product which reflects those requirements. They point out that out there in the real world, the fact that requirments, needs, purposes, or what have you don't actually come ready made. many problems, that is, are ill- defined, or poorly specified. Soft Systems recognises that the very step of identifying/ defining a system is problematic in almost all cases (engineering is a special case where this is not true). At the root of this problem is the difference between 'systems models', or abstractions, and concrete real world situations.

Systems analysis has to cope with two problems;

1. It must be orderly,

2. It must represent complexity.

In order to cope with these two problems, C and S. have laid out schema. It has historically been associated with SEVEN STEPS, although Checkland and Scholes latterly have argued subsequently this is too simplistic.

This 'seven steps' model is;

1. Recognise the problem situation as problematic.

2. Express the problem situation

3. Provide root definitions of purposeful human activity systems. There may be a number of them, for instance including activites as a 'social' system, as a 'political' system, and as a 'cultural' system. Also these systems may be in conflict. SSM is a means to bring these different perspectives together and identify how they relate. It has been very influential in computer systems work such as 'viewpoint analysis'.

4. Provide conceptual models of these systems

5. Compare these models with the real world

6. Identify the changes which are desirable and feasible

7. take action to improve the situation.

In each instance, the system concepts are supposed to be used to enable the people in the system to learn how to take appropriate action. remember, this is only an organising scheme. **It does not imply step by step and has clear elements of iteration.**

There are two streams of enquiry. That is, there are two separable analytic modes the analyst can use. They are:

1. LOGICAL,

2. CULTURAL

1. LOGICAL,

Selecting Relevant Systems

If a problem has been identified, then the task is to identify the systems that are relevant to it. No-one is pretending this is a scientific process, it is experiential.

Naming Relevant Systems

The root definitions are to be be established using the acronym of **CATWOE**.

Customers

Actors

Transformation Process

Weltanschaung (worldview)

Owners

Environmental constraints.

This is a complex way of saying something fairly straightforward. What it means is:

Transformations are ways of describing inputs and outputs- ways of turning what you start with into something else. According to your worldview there will be many different ways in which these transformations can be expressed.

The rest of it refers to the fact that, "someone must understand the purposeful activity, someone could stop it, someone will be its victim or beneficiary, and that this system will take some environmental constraints as given."

Modelling Relevant Systems.

C and S use the example of painting a fence by hand at home:

C Householder
A Householder
T unpainted fence- painted fence
W amateur painting can enhance the appearance
O householder
E Hand painting

the point is that various subsystems can be identified, thus the core activity of painting the fence can be decomposed into;

Appreciating the colour scheme of the property
Decide on the scope of the fence painting task
Deciding on the fence colour
Obtain materials
Paint the fence

Monitor your work
take controlling action
Define and measure performance.

various ways of viewing the transformation are possible;
Does the means chosen actually work?
Does it work at least cost?
Does it meet longer term aims?

Comparing the models with reality.

The models are only a means to an end. To be useful, they must be related to actuality. Using the models can help structure analysis and debate about the real world problem situation by filtering through a range of worldviews. Methods by which this can be done include informal discussion, formal questioning, scenario writing, and modelling the real world using the concepts evolved.

2. CULTURAL

It is important, parallel to the logical modelling activities described above, that we find out about the culture of the work being done. In other words, as well as being purposive, beliefs, feelings, and meanings attached to activities are significant. Checkland and Scholes gloss this as 'culture'.

Rich pictures.

There are no formal methods for deriving culture (!!!) The pictures drawn can be idiosynchratic and individualistic. It is interesting that C and S. see pictures as a literal device. ie. Drawing pictures is a useful way of helping people understand situations.

Analysis of the intervention.

Interventions affect the participant. This was known at the time of the Hawthorne experiments and is well known to ethnographers.

Checkland's analysis describes 'roles' that various participants can take, including those of 'clients', 'problem owners', and 'problem solvers'. Clients are of course the people who caused the study to take place. 'Would be problem solvers' will be whoever wants tyo do something about the problem situation. 'Problem owners' are to be determined by problem solvers. Identifying these roles is called analysis ONE in SSM.

'**Social system' analysis**.

SSM sees the social system as a set of interactions between ROLES, NORMS, and VALUES. In this respect it is surprisingly conventional, because such concepts are standard interactionist concepts in sociology. This is Analysis TWO in Checkland's terms.

ROLES- A social situation recognised as significant by people in the problem situation. Roles can be formally (ie Institutionally) defined as with the role of, for example, Lecturer or Student; or they can be informally defined as in 'good' lecturer', or 'very good lecturer'. Many roles are individually recognised, especially in peer groups, and may include such qualities as being the 'Joker', the 'Nutter', the 'Solid Citizen', and so on. Roles can be variously defined and often include conflicts of perception (for instance, the contrast between professional excellence and the happiness of clients. By way of example, it is well known amongst solicitors and

police persons that the most important part of the job is making clients THINK you are doing a good job for them.

NORMS are the expected behaviours associated with roles, and

VALUES are the actual standards of performance. ie Beliefs about 'good' and 'bad' Again, there may be many different perceptions on this. One point that Checkland makes is that this kind of belief is elusive, and merely asking questions in interviews tends to result in a standard, official, organisational view. (This is very close to one of the arguments that ethnographers typically produce.)

'Political system' analysis.

That is, understanding the lines of power, and how power is expressed.

Analysis THREE as it is usually called, is to do with how the various different interests in organisations reach accommodation or consensus. HOW power is expressed, for instance in terms of formal authority, intellectual authority, charisma, reputation, access to info., membership of strategic groups, and so on, is the focus of this analysis.

Checkland rightly points out that the design of IT has been treated as an engineering problem, again quite consistently with what sociologists have been saying. Further, the underlying models for information systems have been dominated by 'hard' systems thinking- that is, design principles which start from the means (the computer) rather than the ends (organisational purposes). Checkland sees SSM as being part of the tradition of 'human centred design' associated with participative design, and makes a contrast between this view which treats information as human symbol, rather than information as data. Traditional information theory (eg Norbert Wiener) treats information as a 'message' which is 'encoded' into a 'signal' which is then 'decoded'. It is a highly mathematical/ statistical approach. It enables measurement of what is being transmitted. However, it tells us nothing about the interpretation of what is being treated. That is, **an information system involves both data manipulation and meaning attribution**. That is, the boundaries of an Information System will have to include human action. As Checkland says, "Of course, the designers of the data manipulating machine will have in mind a particular set of meaning attributions and will hope that the manipulated data will always be interpreted as particular information- but they cannot guarantee that, since users are ultimately autonomous.

He argues that a 'truly relevant' system can only evolve through agreement (again this looks very much like PD), and gives some recommendations concerning what to ask when deriving an information systems model.

What information would have to be available to enable someone to do this activity?

From what source would it be obtained, in what form, and what frequency?

What information would be generated doing this activity?

To whom should it go, in what form, with what frequency?

"In particular, SSM could enrich those poverty-stricken stages of systems analysis and design methodologies in which information requirements analysis is assumed to be straightforward, or organisations are naively documented as a set of unproblematical entities and functions." .... "But the detailed linking of SSM to detailed design .... has not yet been accomplished."

Patching has more to say about this, "Essentially, organisational analysis is at the root of using SSM to advise on the requirements for new technology, as it encourages the analyst to consider the overall purpose of the institution, dvelop root defintions and conceptual models to illustrate this purpose in systems terms; decompose and compare models with real situations; and where there is a mismatch, *consider the use of the technology to achieve an improvement.*"

Unl;ike other perspectives mentioned, soft systems analysis has pretty much nothing to say about two important CSCW related issues:

1. 'tacit', 'local' knowledge, or 'skilful' working.

2. the relative merits of different viewpoints.

Rather it is consensus reliant, and presumes that organizational members can and will provide an adequately 'rich' picture of what's going on.

Business Process Re-engineering

We deal with Business Process Re-engineering here for two reasons:

1. In the real world, process driven change management remains the dominant approach, and,

2. Though not dominant in CSCW, there is a literature which seeks to link BPR concerns a those of 'situatedness'.

Whatever the faults of BPR, it serves to raise a number of issues which arguably had been in t background for a long while.

Firstly, it recognises the importance of I.T. in affording change (see Davenport, 1993), a stresses that I.T. of whatever stripe will not be effective unless specifically designed to me management goals.

Secondly, and following on from this, its 'rationalist' auspices lead to an emphasis on plannin The point here is that CSCW's concern with 'situatedness' is sometimes taken to be predicat on the view that organizational planning is misconceived. This is a mistake. BPR and CSC come together most precisely in areas where the design of 'Workflow' systems are the prima objective.

Thirdly, BPR places a heavy emphasis on fieldwork, though of a rather different kind than t typical ethnography.

Business Process Re-engineering, like many of the change management strategies in existen actually covers a multitude of sins ranging from a progressive refinement of business objectiv in terms of core processes, (BPImprovement) to a very radical and high risk approach complete organizational redesign (Process Innovation). It is also, unsurprisingly, regarded having some promise as an aid for requirements capture. When the advocates of BPR sugg that process evaluation should take place through a series of measurable characteristics that c be evaluated, documented, and agreed, what they are suggesting is analogous to the production a requirements analysis and specification. However, we believe that it is prey to exactly the sai problems as are present with the structured design process.

"A process is a structured, measured set of activities designed to produce a specified output for particular ... market."

Certain features are more or less common to all versions of BPR:

1. A concern for customers, and particularly measurable aspects of the customer relationsh implied in notions like the value chain.

2. The concern for what goes on rather than the formal structure of the organization. Hence:

"The term process innovation encompasses the envisioning of new work strategies, the actu process design activity, and the implementation of the change in all its complex technologic human, and organizational dimensions." (Davenport, 1993)

He goes on to say:

"It implies a strong emphasis on **how** work is done within an organization, in contrast to product focus's emphasis on **what**."

(Davenport, 1993)

3. As the name would suggest, BPR sees conceptualizing what goes on in organizations as matter of understanding 'processes'. Harrington describes a process as:

"any activity or group of activities that takes an input, adds value to it, and provides an output an internal or external customer. Processes use an organization's resources to provide *definiti* results."

A Business Process in turn is defined as, "All service processes and processes that supp production processes. A business process consists of any *logically related* tasks that use t resources of the organization to provide defined results in support of the *organizatior objectives*."

(our italics).

Indeed, a recurring theme in all BPR versions is the distinction between the logical connecti between activity, which tends to be horizontal, and the vertical connections of the organizatic That is, BPR also has a strong interest in WORKFLOW. The general objectives of BPR include

a. Preventing errors from occurring

b. Providing a view of how errors occur and a method for correcting them

c. Developing a complete measurement system for the business.

d. Providing the organization with a measure of it's poor quality costs (ie waste)

(Harrington, 1991)

That is, despite changing the traditional concern of organizational theory from structure process, it remains embedded for the most part in the Rationalist tradition. In this regard, BI has clear goals in view for organizations, regardless of whether in practice clear a

unambiguous goals are shared by all. Organizations should be seeking processes which are we managed and thus:

a. Effective. That is, they should produce the desired results.

b. Efficient. That is, they should use the minimum resources necessary to achieve those results.

c. Adaptable. That is, should be capable of change when customer requirements change.

4. A clear implication of the process focus on definitive results is that there would have be criteria which are accessible to measurement. Thus, "measurements are key. If you cann measure it, you cannot control it. If you cannot control it you cannot manage it. If you cann manage it you cannot improve it." (Harrington) This is an explicit account of a key feature BPR, which is that it is inherently positivistic. What cannot be scientifically measured is not any great significance to the analyst.

What might you measure?

Time taken
Cost
Usefulness of inputs and outputs.
Freedom from defect

Through the insistence on measurement and control, it implies:

a. A central role for I.T. in the redesign of business, and

b. A central role for business in the design of I.T.

It is a stepwise approach.

I. Identify the business in terms of its key processes, not in terms of its products, division or functions. Why? Because identifying process is the first step towards reducing time and co for improving quality, to enhance customer satisfaction, and so on.

Processes are not necessarily that simple, although there is the claim that for any business it possible to identify a few 'core' processes- between 2 and 4.

Identifying processes will incorporate a number of elements:

1. Enumerating the major 'high level' processes.

a. This should be iterative, enabling an ever sharper focus, and clearer identification boundaries.

b. It is generally presumed that this should be a top- down affair, starting at managemei (contrast with Quality initiatives)

2. Determining the process boundaries.

This includes, for instance:

a. Identifying the ownership of the process and where it begins and ends.

b. Identifying sub- processes.

c. Identifying the benefits accrueing from combining processes.

3. Assess the strategic relevance of each process.

This means:

a. Identifying the processes the company wants to change. (and based on its resources)

b. The processs should be central

c. The culture surrounding the process should be favourable

d. The process should be 'unhealthy'

Judge the 'health' of each process (ie is it done efficiently?). One method for doing this is t existence of 'multiple buffers', which produces 'queueing up' of stages.

Qualify the culture and politics of each process. If commitment to change is low, there is lit point in implementing change.

The benefits to be obtained from the emphasis on process are:

1. Duplication elimination. Obviously, if the same activity is being conducted in two differe locations in an entreprise, then there is unnecessary duplication.

2. Error proofing. Errors are notoriously easy to make, which is precisely why so many wo activities develop which constitute checks on other activities.

3. Standardization. This is probably the approach that has had most take up in Europe and in t US. The idea is fundamentally that processes can be simplified such that they become standa right across all branches/departments/geographical locations. This is normally done by specifyi the relevant procedures for given activities. These procedures in principle confer a number advantages, notably that in principle they should be easy to understand, the training overhead reduced, and ambiguity is removed. Staff should become to a degree interchangeable.

4. Automation. Business Process Re-engineering is indicative of an increasing realisation th Information Technologies and organizational change are inextricably tied to one another. such, it has much to say at least implicitly about the human/machine allocation of functi problem, in that it tries to spell out what the criteria might be for deciding what machines can in terms of the way they might enhance efficiency, effectiveness, and adaptability. Certainly, if is possible to definitively measure increases in these criteria, then it may also in principle possible to measure the contribution the technology makes.

Methodology.

BPR and its variants are relatively strong on methodology. In fact they often describe themselv as systematic methods. Both Harrington and Davenport (1994) spend considerable time analysi

methods to be used. In Harrington, they involve a series of objectives and associated activities f meeting them. The objectives are:

To ensure success by building leadership, understanding, and commitment.

To understand all the dimensions of the current business process.

To improve the efficiency, effectiveness, and adaptability of the business process.

To implement a system to control the process for ongoing improvement.

To implement a continuous improvement process.

Analytic teams and their skills are developed whose job is to pursue the tasks that will achie these objectives. The initial task is to determine where the process boundaries will be (whe processes will be deemed to start and finish), and what the inputs and outputs to the process a From there, suppliers to, customers of, and related processes to, the process are identified. T process is then block diagrammed to identify "who is performing the key operations." One bound again to ask how, if the performance of key operations is dependant on cooperation to a significant degree, this cooperation will be visible to a BPR methodology.   Interesting according to Harrington, one of the tools that can be used in BPI is "structured analysis/desig BPR analysts thus advocate Flowcharting as a key method, and in this respect are clea borrowing heavily from the system design process.

The main methods used are:

Process walkthrough. This is designed to facilitate understanding of the characteristics business processes. Workflow is defined as the method for transforming input into output, and one of the primary characteristics of a process. Process walkthroughs, wherein task descriptio are collected through the observation of what is going on. Observation of the process is done ' the task level". Based on the task analysis that has been undertaken, interviewing is conduct which is designed to evaluate and compare task performance. Normally, some standardiz questions would be prepared so as to structure the interview process. These questions mig concern such matters as training; quality of output; feedback from clients; and so on. At fi sight these methods are closely akin to what we might understand ethnography to be:

"One of the key activities in the BPI [Business Process Improvement] walk-through process is to observe the activity being performed. Immediately after the interview, the interviewer and the interviewee should go to the work area to observe the activity discussed in the interview. Observing the individual tasks being performed will stimulate additional questions. As Dr. H. James Harrington puts it, "You never really understand the activity until you do it yourself. If that isn't possible, the next best alternative is to observe the activity while it is being performed, and ask a lot of questions."

 (Appendix to Harrington, 1991, written by D. M. Stowell)

However, the similarities are only apparent. Firstly, there is no suggestion that the observati should be sustained, nor is it clear that routine problems will be identified and articulated a result. One of the facets of the ethnographic insistence on naturalism is that it presumes that it at least possible that the kinds of things people might say during an interview or while watchi work are not necessarily what they might say while doing the work. Further, there is no means compare the different strategies the experienced and the inexperienced might use, what regarded as good and bad practice, or what happens when unusual situations arise. In sum, su

walkthroughs are akin to the processes associated with participative design, and subject to t same potential weaknesses (notably the problem of 'superusers').

Perhaps more importantly, BPR takes for granted the conceptual orientation one might bring observation,and indeed to the questions one might ask. Thus, where BPR protagonists a insistent on the need to identify problems, they have little to say about the prospect that proble identification might be contextual itself. In particular, BPR explicitly frames **problem according to the gap between specified procedures and actual practice, where practice seen in terms of task performance and completion.**

This is not to claim that BPR is somehow mistaken or misguided. Many of the items it sugges are worth looking out for, such as comparison between the formal process and actual practic differences in the way employees perform tasks; training requirements; process problems a 'roadblocks', and so on, constitute useful analytical foci, and overlap to a limited degree with t kinds of thing ethnography might tell us. A strength of BPR modelling is that it recognises th the process specification and the activity are not the same thing. Thus, deviation from process explicable by a whole range of factors, such as misunderstanding or lack of knowledge, but al because there may be potentially positive reasons such as finding a better way to do things, or least compensating for problems. One very significant element of this is a description problems which stresses the role of 'chronic' problems in working life, because, it is argued th chronic problems are often difficult to see. This in turn is because methods for completi processes often adapt to chronic problems. That is, people often find ways round persiste obstructions and the fact that work can be done effectively is sometimes despite problems of th sort. This has an importance that is not always realised in the evaluation of technologies. (O caveat here is that occasional problems may be equally significant, but in different ways. F instance,in Safety Critical environments occasional problems are potentially disastrous precise because operators may be unfamiliar with them.)

Our main objection to BPR lies in its presumption that measurement is the exclusive test effectiveness, efficiency, and adaptability. That is, the method is characterised by claims to scientific status, but nowhere comes to terms with the possibility that there may be any numb of versions of the 'problem', or indeed that specifying a 'problem' may be a matter understanding significance rather than process.

II. Envision the new work strategies.

It is at this point that I.T. becomes extremely important. It is argued that IT. is potentially vi for process redesign. This is despite the fact, and indeed is critical to the arguement, th historically the benefits from I.T. have been dubious. Yates has shown how slowly ne inventions such as the telephone, the filing cabinet, etc. changed business practice between 18 and 1920.

Roach has pointed out that massive additional expenditure on IT. resulted in little productiv gain (85% of IT investment was in the service sector, but has resulted in 0.8% productiv increase p.a. since 1982)

The argument is that this is because the potential of IT. has not been allied to ne processes. (and despite the fact that even traditional systems design was explicitly about proce Indeed, anecdotal evidence suggests IT use in Japan is amongst the lowest in the industrialis world,but has the highest productivity rates)

IT should be seen as a process enabler. That is, it will not produce change on its own, but c enhance productivity when allied to process change.

III. Design the new strategies.

The vital point here is that new strategies cannot be properly designed unless the current ones a fully understood. Doing this has at least four advantages:

1. It facilitates communication amongst participants. Models and documentation is an effecti
means to do so.
2. It provides a map for migration.
3. It avoids such traditional problems as 'automating your mistakes'.
4. It enables a measure of value for the proposed changes.

The methods to be used include:
Description of current systems.
Measurement of processes in terms of objectives.
Assess the current process in terms of the new process.
Identify short term improvements.
Assess current technology and organization.

New processes should be, eg. :
Presented as alternatives through brainstorming.
Should involve assessment of feasibility and risk.
Involve prototyping.
Assessed at each level-process, sub-process, and activity.

IV. **Implement the new processes** in all their "complex technological, human, ar
organizational dimensions."

Organizational rather than technical barriers are the most obdurate.
It requires managing behaviour as well as structural change.
Likely sources of resistance and hostility need to be identified.

Summary- analytic stances and the practice of fieldwork

The above review suggests some significant analytical variations, depending on theoretical perspective taken. We are not here trying to persuade readers of the superiority of one perspective over another, or vice- versa, but to show some of the consequences of adopting one stance in preference to another. The dimensions across which we can see these variations might be characterised as follows:

1. Orientation to change

It should be apparent that the perspectives described above differ radically in their orientation to change, although they all have in common their treatment of design as being a 'work' and 'organizational' issue. At least two of them take an 'up front' approach to this. BPR and P.D., in their very different ways are clearly and unapologetically interventionist. Others, like Grounded theory and 'soft systems', have a slightly more sophisticated 'take' on this, in that by implication, too precipitate a view of strategy would be extremely risky. Ethnomethodology has the most controversial approach, in that, in some versions at least, ethnographies should in the first instance be 'innocent'. That is, it explicitly states in the CSCW context that taking on the concerns of designers at an early stage is an analytic error. It further refuses to theorise about how one eventually does go about orienting to change, contenting itself with treating the relationship with designers as an entirely practical matter.

The point is that these different takes have consequences for the emergence of lines of enquiry. Fieldwork under the auspices of BPR is going to be very much a matter of 'fitting' evidence to conceptual categories that are systematically applied. Further, fieldwork of this kind is going to constitute management information, and explicitly so. The existence of other versions is unlikely to be seen as relevant here. PD in some respects takes an entirely similar, if structurally opposed, view.

Nevertheless, all these perspectives have one thing in common- the argument that the classic 'Waterfall' approach to design exemplifies 'hard systems' thinking, and seriously underestimates the requirements problem. Of course, this is not to trivialise the work of Software engineers. It has long been understood that poorly understood domains require a complex and iterative approach to requirements. Checkland's point, however, and it is one that several sociologists in CSCW have also made, is that the problem is an analytic one. Put simply, how to go about understanding the problem must precede decisions concerning what to do about it. The reason we emphasise this point so strongly is that examination of various candidate solutions to the design problem, as we hope we have shown, indicates that each is founded on a rather different set of analytic assumptions.

2. 'Formal' versus 'Informal'.

Following Suchman's deployment of ethnomethodology for system design purposes in 'Plans and Situated Actions', there has been much debate in CSCW concerning the relationship between the 'plan' and 'action'. (Discussion of this theme goes on- see Schmidt, 1997; Bardram, 1997) Suchman herself has pointed out several times that her conception of this relationship has been misunderstood by commentators. Methodologically, whatever the status of the two, this can be glossed as posing the field of study as being precisely about the connection between 'formal' and 'informal' processes (although ethnomethodologists including Suchman and ourselves would strongly resist this separation). In many respects, all the perspectives discussed above can be seen in these terms. Even BPR emphasises the need to study 'work arounds', albeit with a view to formalising informal activities. The main difference with the other approaches is the degree to which this analytic problem can be seen as the relationship between 'individual' and 'system' (Soft systems, Distributed Cognition, Activity theory (?)) or as collapsing the distinction entirely, rejecting notions of individual cognition and of 'system', and substituting 'accomplishment' (ethnomethodology)

3. Problem specification

The effect of interdisciplinary claims on design is to make it an ever more complex problem. The problems which software developers are asked to solve today are in any case often immensely complex without this complication. Systems of a radically different kind; of a new order of complexity; which are distributed, and so on all share the common feature that there is often no pre-existing system to serve as a basis for the software- a condition which applies particularly to CSCW systems. That is, establishing the services the system should provide and the constraints under which it must operate (requirements capture and analysis) is a matter of *discovering the nature of the problem before one begins to define a solution.*

As has been noted elsewhere (see Rittel and Webber, 1973; Checkland, 1981), the root of the problem lies in the nature of 'systems' and how we think about them, and here 'systems' refers to the organizational complex rather than to the technology. For Rittel and Webber, the main difficulty is that the problems being tackled are usually 'wicked' problems, a 'wicked' problem being a problem for which there is no definitive formulation. The theoretical stances rehearsed above all show different orientations to problem specification. On a wholly artificial continuum, we can see that approaches such as BPR take a 'hard' analytic position, in that 'process' problems are regarded as self-evidently the most serious, regardless of context. For Checkland and 'soft systems' analysis, such a stance would be precisely an example of 'hard' systems, or engineering thinking. That is, it derives from the viewpoint that the task starts with the construction of a solution rather than the identification of the problem. As Rivett has argued, formal models of decision making tend to ignore the fact that change is "A complex process which is a mixture, in practice, of fumbling, mind- changing, chaos and political intervention." (Rivett, 1983) In sum, 'hard systems' thinking arguably has trouble coping with contingency. Perhaps one of the reasons for the (small) popularity of Glaser and Strauss' perspective is the evolving nature of theoretical work, and its contingent refining. Certainly the most radical version of problem specification is that of ethnomethodology, in that it refuses to treat any phenomenon as a problem in any sense other than the way in which it is treated as such by participants to the work.

The issue of problem 'formulation' is evidently an increasingly complex one.

In the specific context of system design, the complexity of the problem space may be a function of any number of different technical, human, and organisational issues, but will certainly include the following:

a.   Large software systems are usually required to improve upon the *status quo* where either no system or an inadequate system is in place. Although difficulties with the current system may be known, it is hard to anticipate what effects the 'improved' system is likely to have on an organisation. It is a critique of ethnomethodological stances, for instance, that they do not deal systematically with problems of this kind, whereas BPR does so explicitly. Nevertheless, the problem of *when* one is adequately prepared to make guesses, informed or otherwise, about the consequences of new technology, work practice and organizational form is a vibrant one, not least when it comes to evaluation.

b.   Large systems usually have a diverse user community who have different and sometimes conflicting, requirements and priorities. The final system requirements are inevitably a compromise. Many of the perspectives we cite are, at root, methods for understanding the different viewpoints organizational members might have. It is arguably a weakness of BPR that it underspecifies alternatives to the management view.

c.   The procurers of a system (those who pay for it) and the users of a system are rarely the same people. System procurers impose requirements because of organisational and budgetary constraints. These are likely to conflict with actual user requirements.

d.   The iterative nature of the Requirements process, from 'capture' to 'specification', and the attendant problems of communication, understanding, contractual obligation, and so on.

Our aim in this tutorial is not to privilege one perspective above others, or to suggest that the long sought 'magic bullet' might be found among these candidates, but to emphasise that it does a different kind of analysis- analysis which is likely to prove relevant to systems design as the design process itself orients more and more to business and organizational issues.

One way of thinking about the relative merits of these different perspectives is to think about their analytic consequences for separating (or not, as the case may be):

4. task, organization and culture. Doing 'real world' studies, under whatever auspices, could be seen as providing tools for getting to grips with each of these concepts. Whether they all do so equally well, or in the same way, is debatable.

a. Task issues. These are, to put it simply, to do with understanding what gets done, and how. It is quite clear that perspectives such as ethnomethodology and distributed Cognition make much of their analytic power for this purpose. BPR would make a similar claim, but in a rather different way. Other perspectives, for instance, Soft Systems, and more contentiously, P.D., might be less useful for this level of granularity.

b. Organizational issues, at the very core of CSCW, are increasingly being defined according to a variety of change management philosophies, theories, and practices which have their roots in some classic sociologies of organizations. The great merit of BPR, and for that matter Soft Systems, is that they provide strong versions of what it means to understand the 'organization', at least as constituted in rules, processes and procedures.

c. Culture. Organizational culture is one of the great 'mysteries' of organizational theory, and it is not the place here to recount the debates between rationalists and others in this context. Suffice it to say that the Human Relations School and the various versions of socio-technical systems theory that have followed upon it have had a profound impact on recent organizational concerns with the notion of 'culture', concerns which are shared by assorted writers in CSCW. Organizational culture is not easily defined but a useful definition is:

" ... the solutions to external and internal problems that have worked consistently for a group and are, therefore, taught to new members as the correct way to perceive, think about, and feel in relation to those problems."

(Schein, E.H., 1989)

Understanding the relevance of such a vague concept is difficult in the extreme, but the likes of Soft Systems make much of it, as indeed does P.D. Much of this interest in organizational culture comes from the prospect that changes in cultural expectations can be managed and controlled. If so, it is generally accepted that changing a culture is especially difficult, because of the very pervasiveness and subtlety culture possesses. Nevertheless, this interest has burgeoned, not least in and through the advent of Total Quality Management.

In many ways, of course, the issues we recount above have to a greater or lesser extent been the concern of CSCW for some time, and much of the research that has been undertaken in CSCW has attempted to orient to some notion of organizational context in and through analysing task, organization and culture. Many examples of what we can conveniently term evaluative ethnography now exist to illustrate the point (see for example Orlikowski, 1992). It would not be terribly controversial by now to argue that such workplace studies have provided an excellent method for the critique of existing systems, and serious attempts are increasingly being made to integrate them into the design process itself, not without some difficulties. (see Hughes, Randall, and Shapiro, 1992; Bentley et al, 1992)

Fieldwork, potentially, has a significant role to play here in providing a contrast between the definition of problems given from the outside, whether by systems designers or change management specialists, and the problem seen from the point of view of the person(s) doing the work. Problems seen this way, from the participants point of view, help us gain purchase on some features of work that are commonly overlooked, notably how the flow of work is distributed according to the principle of 'What should I do next?' and consequently on the problem of, for instance, interruption. Equally, where many techniques exist for assessing the frequency with which problems arise, little emphasis is placed on their *significance* for participants to the work.

The kinds of solutions habitually adopted to problem solving tasks are accessible in principle to a number of the perspectives we recount. What it is less clear is how to relate problem solving strategies to context. At this point, we simply wish to suggest that the detailed and focused analysis of fieldwork data can help us understand knowledges, skills and expertises can be can be deployed in mutual ways which are often extremely subtle. In this respect, ethnography acts in contrast to orthodox conceptions by placing skill, expertise, and experience in contexts which participants to the work would recognise. That is, it can describe participants' orientation to problems such as 'Who or what do I need to help me and how?'. The existence of patterns of skill and expertise is, of course, of fundamental importance to the allocation of function problem in systems design.

Practical issues- 'if you *must* work together ....'

The 'hype' surrounding ethnography seems to grow apace. Recommendations to do 'ethnographies' are now to be found in a wide range of disciplines, not only CSCW. Nevertheless, we believe too little attention has been given to the analytic auspices under which fieldwork takes place, and to the practical problem of 'what is it for?' in the system design process. That is, and some eleven years after Suchman published 'Plans and Situated Actions', it has yet to come to maturity in the systems design process. Without wishing to critique specific pieces of research, we believe that too often it is regarded as either:

1. Merely being the same thing as 'hanging around' picking up pointers about what's 'really' going on, or

2. Regarded as a useful method for collecting data which is *sociologically* interesting, and to which a systems 'spin' is only subsequently given. This problem. Of how to relate ethnographic fieldwork to system issues, is an obdurate one.

It has less often been a method where the problem of integration with systems issues has been a central concern, and hardly ever, in our view, one which has successfully contended with the dominat 'rationalist' strand of enquiry in, for instance, organizational theory, cognitive psychology and system design. We say this not to criticise these latter perspectives, but to point out that the issue of complementarity remains a vibrant one. **'Situatedness' in CSCW runs the risk of being a catchword, rather than a serious alternative to** the 'top down' , or decompositional models, commonplace in most disciplines. In particular, the matter of how business strategies which are inherently 'planful' relate to the 'situatedness' at the heart of ethnographic studies is likely to prove critical.

The use of computer systems in everyday work grew dramatically during the eighties. As the cost of the technology fell, the applications of computer systems grew to the point that the personal computer is now considered a ubiquitous and almost invisible tool within most users' professional lives. Consequently, as Grudin (1990) argues, the focus of the interface has altered and the nature of the work situation within which the computer is placed has become of paramount importance in the construction of computer systems. Nevertheless, design methodologies do not seem to have adjusted to this focus on 'work' and in our view still seriously underspecify the analytic work that has to be done to gain a purchase on it. Moreover, as pointed out above, the design of new technology is being increasingly influenced by management theories which pre-suppose analytic approaches which may be very distinctive from those of ethnography.

In the case of CSCW this issue is particularly acute as the development of cooperative systems requires a significant understanding of the cooperative work taking place as the system interface moves into the world of work. The desire to service this need encapsulates the problems for the traditional forms of requirements capture. As CSCW moves beyond the individual user to recognise the socially organised character of work we have to investigate the social nature of work within the requirements

capture process. To acknowledge that work has a social dimension to it presents system design with new problems; problems which centre around describing and specifying what these social dimensions might be. It is this issue which brings sociology in as one of the collection of disciplines which inform both HCI and CSCW.

However, although it might bring sociology to the both the HCI and CSCW table, it does not do so unproblematically. Since its inception, sociology has been preoccupied with the nature of work and its social organisation, but this is far from saying that it has successfully developed an interest in, and an apparatus for the analysis of the 'real world' aspects of work. Indeed, placing on one side for the moment the connection with HCI or CSCW, sociology and its methods of research are themselves very much open-ended and unfixed matters. In pointing out that methodologies for the social analysis of work were neither 'well formed' nor in regular use before the advent of CSCW, we are expressing caution about the use of relatively 'untried' methods in this area. This is not to say that issues of ethnographic practice and its relationship to theory have not been previously examined (see Hammersley, 1990; Stanley, 1990; Hammersley and Atkinson, 1983), but that the particular problems associated with the conduct of ethnography *for system design purposes* are less well articulated. This does not, of course, make ethnography a wholly untried technique in the interdisciplinary research arena, for there are by now a number of examples, which include for brief mention:

Hughes, Randall and Shapiro, 1993

Goodwin and Goodwin, 1993

Heath and Luff, 1991

Nardi and Miller, 1990

Suchman, 1983

Randall and Hughes, 1994

Harper, 1998

Nevertheless, only in a few of the examples available do such ethnographies explicitly take on design as a matter of practical consequence and equally, few examine the processes of integration between ethnography and design that would be necessary. We specifically want to stress, therefore, against much of the hype that is often associated with 'new' methods, including those used in HCI and CSCW, that ethnography is not a panacea for understanding user requirements. It is a tool and, like all tools, must be judged against appropriate criteria as to what it can and cannot deliver to systems development. It seems to us that that are reasons for caution in at least two respects:

1. Transferability to Commercial Arenas.

The kinds of question we have in mind are issues of the use of ethnographic material, and indeed of the ethnographer, in large design teams, with all of the associated problems of agenda management , cultural difference, and so on.

11. Applying Research to Systems Design Issues.

The arguments for exploiting ethnography are also the arguments for bringing in a sociological perspective which enables system designers to take account of the socially organised character of work. What we signal by the phrase, "the socially organised character of work", are those aspects of work which are features of the

collaborative nature of work and its activities; aspects which include more than one might conventionally think. It is axiomatic for sociology that much of human life involves interaction with others and that our individual activities are oriented to this fact. Our actions are embedded in a network of relations with others; relations which can vary in scope, intensity, affectivity, formality, and more. Thus, in work a familiar network of relations is the formal organisation, be it a firm, a professional agency, a corporation, a political party, and so on. However, equally important are the plethora of informal relations which enable work to take place.

The importance of this for both HCI and CSCW can be illustrated by Procter and Williams' (1992) remarks on the problem of defining the user:

"...when HCI practise is placed within an organisational context ... Is the user the 'end user', the person who directly interacts with the computer or the 'client', the person who commissions the system? There is insufficient acknowledgement of the complexities of organisational life, and that the requirements of various interested parties might conflict".

What they are pointing to are the problems that emerge when HCI moves away from the comfortable picture of the user as the individual sitting in front of a VDU to take into account the wider context in which individual's work. In this respect, as a number of commentators have noted, we do not have an adequate picture of who users are. This very problem has plagued the requirements process from the earliest days of systems development and, as we saw in the previous section, is hardly dealt with in a nuanced way. Clients, for example, are not always users and, indeed, may not even know who their users are. Users may know who they are but may not find it easy to articulate what they know. Matters are complicated by the fact that organisations often give rise to vested interests which influence not only the impetus for change but also the direction. One could add more but, hopefully, the point is clear. It seems, and of course we would wholeheartedly agree in principle, there is a prima facie case for ethnographic investigation of the issues which bedevil the systems design process. However, recognising a need is by no means the same thing as providing a solution. If we are to address the problem of integration, then a whole gamut of related problems, some of which are examined below, need to be examined.

The purposes of method in CSCW

A variety of methods have emerged to support the capture of users needs and the development of systems requirements. Each of these methods has it own strengths and weakness which are not always clearly perceived or even known about. It is vital to understand from the outset of any discussion of methods which tackle the problems of capturing users needs that there is no 'silver bullet' to solve all the problems of systems design (Brooks 1987). This is particularly true in the case of the highly interactive systems which predominate CSCW and are formulated upon understanding the needs of their user community. The question to ask about any method is, what purposes is it designed to serve? In the context of CSCW this is essentially a matter of establishing effective interdisciplinary communication.

To re-iterate, all methods have *theoretical* purposes. They are informed by foundational principles, sets of assumptions, conceptual frameworks, which serve, sometimes implicitly, to shape the kind of questions the method is seen as capable of answering. Thus, and for example, task analytic researchers tend to focus on information processing, representational modelling and so on. Also, experienced fieldworkers who are used to the practical issues at stake in the conduct of ethnography, are drawn from disciplines other than system design and, accordingly, often have their own agendas which may, or may not be, compatible with the purposes of design.

In the context of CSCW, or wider HCI, the method must serve the *practical* purposes of system design. It is this which makes CSCW an interdisciplinary endeavour and turns sociology into an 'applied' discipline. This means that a method must also be able to identify, describe and analyse relevant aspects of work and its activities so that design is adequately informed. However, 'adequately informing design', especially using 'soft science' methods, is not straightforward. System designers tend to require either formal or systematic procedures; a requirement which is difficult if not impossible to meet using some of the methods of social science. Indeed, any attempt to do so detracts from the utility of the method and, thus, runs the risk of presenting a highly selective and erroneous characterisation of work.

It is important to stress that many of the methods used to inform system design are themselves being worked out and that what is important is developing a better sense, through an effective dialogue between the human and the computer sciences, of just what a method can and cannot deliver.

Ethnography and the social analysis of work

Ethnography is not fieldwork. Nevertheless, in the belief that many of the problems that arise in doing observational work are common, regardless, of analytic orientation, we treat the two as broadly equivalent from here on. The ethnographic method is that most distinctively associated with sociology and anthropology. It starts from the assumption that human activities are socially organised and so, from the outset, is committed to inquiring into patterns of interaction and collaboration. Unlike the previous methods mentioned which tend to use more formal instruments of data capture and analysis, the ethnographic method relies on an observer going into the field and 'learning the ropes' through questioning, listening, watching, talking, etc., with practitioners. *The task of the fieldworker is to immerse him/herself into the work and its activities with a view to describing these as the skilful and socially organised accomplishment of parties to the work.* One obvious consequence of this is that in the first instance, at least, data collected will be of the 'messy' and unstructured variety. It may include interviews, observations of work sequences, anecdotes, speculations, and so on. The data gathered, in other words, usually takes the form of fieldnotes but is increasingly also supplemented by audio and video data.

From this brief description, we can identify some features of ethnographic practice that are not always well understood by new practitioners:

1. Ethnography is naturalistic.

That is, it predicates its inquiries on the principle that studies should be studies of real people and their activities, operating in their natural environment, whatever that may be. An important justification of the approach is that it is not known in advance of inquiry just what the relevant features of some setting are, let alone how they might be relevant to system design. Thus, and distinct from some approaches derived from cognitive science, it refuses to deal with artificial environments and controlled versions of work but argues that only by studying the natural environment of work and its activities can system design be adequately informed. As Michael Lynch has put it, in another context, "Stop talking about science. Go to a laboratory- any laboratory will do- hang around a while, listen to conversations, watch the technicians at work, ask them to explain what they are doing, read their notes, observe what they say when they examine the data, and watch how they move equipment around ..."

2. Ethnography is prolonged.

We should perhaps point out that there is no logical reason why an ethnography should take a long time, and it has been argued that for CSCW purposes at least there are times when it need not do so (see Hughes et al, 1994), making the point that

duration relates to 'the size of the task'. To elaborate the point, the ethnography of cashier work undertaken by Randall and Hughes lasted approximately one week, and that because it was undertaken in three different settings to ensure validity. Here, the task was quite specific- to understand and assess the kind of problems that cashiers had working with technology when dealing with the public. The 'problem' that is, was tightly bounded by those who had commissioned the work (Nevertheless, the ethnography subsequently 'opened up' and more work was done, lasting another six weeks). The main reason for prolongation is that *for the most part ethnographers have no clear idea what they will find*, and for ethnomethodologists at least should not. Because there are in principle any number of aspects which may turn out to be interesting, and any number of things which may be mystifying, it will take time to form a coherent view of what is going on.

3. Ethnographic enquiries seek to elicit the social world from the point of view of those who inhabit it.

Ethnographies can be undertaken for any theoretical, analytical, or empirical purpose, and as a result ethnography is too diverse a set of practices to be described as a method. At a minimum, however, we would argue that ethnography is (should be) about uncovering the world from the point of view of the social actors within it. For this reason, although it is behavioural- interested in the detail of the behaviour to a greater or lesser extent- it is not behaviourist- it does not consider the behaviour itself as the appropriate level of analysis. The appropriate level is *the significance of the behaviour* for those who undertake it. We discuss below the particular take that ethnomethodologists have on the study of settings. In the context of CSCW, ethnography focuses on the social organisation of *work* activities. That work is socially organised is not a discovery of sociology. The task of ethnography is to take this 'obvious' fact about human life and describe and analyse how this social organisation is accomplished, understood and achieved by social actors. In the context of HCI and CSCW, its purpose is to relate such descriptions and analysis to the concerns of system design.

4. Ethnographic data resists formalisation.

Ethnography stresses the importance of 'context' or 'setting', and thus there can be no theoretical perspective which can explain in advance what one is likely to see in a new setting (*pace* BPR), nor any data which constitutes the 'right' data to be collecting. Ethnographic data takes a variety of forms and can include general desciptions of behaviours, descriptions of physical layouts, close descriptions of conversation, thoughts and feelings about what is going on, tentative hypotheses, examples, repeated occurences, and so on. Inevitably, this makes it rather difficult to distil data down to an 'essential' form, and particularly difficult to do so for system design purposes. Below we discuss some ways in which we can take steps in that direction.

The functions of fieldwork.

We are doubtful as to whether it is sensible to simply regard ethnography as a method which can be unproblematically incorporated into the requirements capture process. It is more a matter which is best described as a method which can *inform* design by identifying the problems and concerns which a system has to accommodated if it is to effectively support work activities. As Procter and Williams (1992) express the point:

"Human behaviour in organisations is complex and subject to a broad range of influences, is often poorly defined, hard to predict and highly contingent. As such it is impossible to capture and represent human social behaviour formally by the kinds of quantitative methods of mainstream HCI. It arises in interaction with others - and cannot be derived simply by scaling up from individual responses".

In which case, this is the problem CSCW must face up to and, as such, is not so much a failure of its methods or its ambitions but the conditions of their realisation.

Some problems.

1. Time and Cost.

It is sometimes argued that ethnography is time consuming and expensive. We are not convinced by the latter argument, since in our experience ethnographers come very cheap, but the former presents a more serious problem. Experience suggests that ethnography can indeed be very time-consuming, especially in 'technical' domains where even intitial understanding can be a lengthy process. This does not mean it will inevitably be so. A ready understanding of some domains, especially where they are tightly bounded, involve relatively small numbers of participants and have limited technical elements may be possible in fairly short periods. (Our Building Society study, which focused on the work of cashiers, was completed in about 4 weeks.) Where there are extensive periods of fieldwork, there is an obvious problem for 'fit' with Structured' design.

2. The 'in the head' nature of some data.

Recording data in itself, as we remark below, can be done in any number of ways. However, and it is important to note it, the presentation of data and assessment of its significance relies very much on interaction between the ethnographer and designers. Where this is relatively unproblematic in academic research environments, in commercial work involving large teams of designers the logistics may be complex. There are reasons for believing that negotiations of 'belief' across 'cultural' or 'practice' communites may also be difficult to achieve without active involvement by the ethnographer.

3. The distributed nature of many activities.

Hitherto, ethnographic research has largely been a 'single person' activity, whereby the researcher spends a considerable amount of time getting to know a particular domain. In organisations where, for instance, much daily contact is by E-mail, telephone, or what have you, observation by one person becomes increasingly problematised. Tracing sequences of activity as they are prompted by enquiries or requests on the part of 'outsiders' from widely disparate locations can be difficult to say the least.

4. The problem of formalisation.

Procedures for rendering data into formal notations which are complete and consistent must be developed if ethnography is to 'fit'. This has turned out to be an intransigent problem which continues to exercise the minds of researchers. We doubt that in any case this is the primary value of ethnography. We believe that the main value remains in high level descriptions of what it is that systems will have to do, what problems have to be dealt with, and how to make sense of the problem of reducing complexity/contingency/unpredictability. It is still very much a matter for debate exactly what it is that ethnography contributes to the design process. *At very least, we want to suggest the following as possibilities:*

1. Establishing a corpus.

Ethnographic studies taken as a whole can begin to give us some purchase on similarity and difference in environments where similar types of system might be deployed. An example would be the way in which Command and Control systems are

used in particular contexts. A number of such studies have now been conducted, and they could be held to include:

Hughes, Randall and Shapiro, 1992

Whalen, 1992

Heath and Luff, 1991

Halversen, C., unpublished Ph.D.

Watts, J. et al, 1996

The point here is that the fieldworker entering a 'similar' domain can be prepared for the subtle variations to be found in their domain by reference to an existing literature 'of a type'.

2. Sensitizing design

Whether or not the conduct of ethnographic investigation can ultimately do much for requirements gathering, there is little doubt it has the merit of 'sensitizing' designers. That is, we cannot know in advance whether problems of 'context' will turn out to be important, and if so for whom, but the simple recognition that they *might* has to be a substantial analytic gain.

3. Informing requirements- one approach

The fieldnote excerpts included in these notes are typical of the form of data which results from an ethnographic observation of a particular domain. Such data, unstructured and often anecdotal in nature, sharply contrasts with the clear and concise structured information which result from a successful application of a traditional domain analysis/ requirements capture method, such as CORE or SADT. Although ethnographic data may contain information pertinent to many different kinds of requirements, such as ergonomic considerations, functional/non-functional software requirements, requirements for staff training etc., finding this information amongst the mass of material is not an easy task.

Ethnographic analyses of a non-trivial nature generate a large amount of information. For example, the fieldnote excerpts included in these notes represent about 5% of the volume of typed up notes collected during our six month study of ATC. This data was collected mainly through the use of handwritten fieldnotes and interview transcripts; the problem is escalated when audio/video recording devices are used to collect data. During their study of London underground control rooms for example, Heath and Luff collected several hundred hours of data on video tape (Heath and Luff, 1991).

The data collected during our study of ATC ranges from specific observations of particular activities to anecdotes and 'war stories' told by workers to the ethnographer. Data varies from being very detailed in parts to sketchy in others, and inevitably there is a significant amount of duplication. Misunderstandings in earlier observations are often clarified later in the transcript as the ethnographer became more familiar with the work taking place. In addition, there is no indication of the relative importance of the different observations; all data is treated as being uniformly relevant and recorded as such. This is summarised by Procter and Williams (1992) when they say:

"Ethnographic data is typically rich, but informal, poorly-bounded and perennially pointing to the provisional, partial and incomplete nature of any account of a social situation ...".

Ethnographic data is therefore ill-matched to software engineers' design agendas, which are focused around finding solutions to well-defined problems. This mismatch can be traced to three fundamental differences in the two approaches:

•   Ethnographers are concerned with analysis; software engineers are concerned with synthesis

•   Ethnographers avoid making judgements about the work; software engineers often have to

•   Ethnography is a prolonged activity; software engineers require information quickly

Analysis versus synthesis

The differing perspectives of the disciplines of ethnography and software engineering are summarised by Hartson and Smith (1991) when they say,

"In the cooperative development activity of behavioural scientists and computer scientists, a gap exists between the skills and goals brought to the task by each of these roles ... The behavioural scientist, trained in analysis and evaluation, is now part of an environment primarily intended for synthesis and design" (page 53)

Ethnography was originally developed by anthropologists to understand social mechanisms in 'primitive' societies. As such, ethnographers are more used to asking questions and making observations than coming up with answers. In performing an ethnographic study, all information is potentially relevant and is recorded and analysed. Observations must fit into a theoretical framework or, if no suitable framework exists, a new one must be derived. In the context of the analysis of work, ethnographers are not concerned with finding improved ways of carrying out the work or posing 'solutions' to observed social problems.

In contrast, the development of computer systems is based on an engineering-oriented approach. A key part of this approach is the notion of abstraction; that is, the hiding of detail of appearance, representation and implementation using higher level constructs. The discipline is very much one of synthesis, involving the construction of complex systems from smaller, simpler components.

An example of these differing approaches occurred during the early phase of our ATC project. The software engineers placed a great deal of importance on building a system model in order to specify exactly what the system to support the ATC process was going to do. This was met with a great deal of reluctance by the sociologists, who argued that the system was, in essence, an integration of activities; it should not be considered as a set of loosely interacting individual activities but as a coherent whole which was more than the sum of its parts.

Non-judgmental versus judgmental investigation

It has been shown in the previous section that ethnographic methods of analysis are concerned with providing a rich, detailed description of the social organisation of a particular domain. Of course, there is a problem here, in that some versions of fieldwork are manifestly non- jusgemental. Ethnomethodologically informed ethnographers regard all events, conversation etc. as being equally relevant and take great pains to avoid making judgements with respect to the relative importance of each fragment of information. In contrast, fieldwork under the auspices of, say, BPR or participative design may not. Our commitments are obvious, but it needs to be

stated that the issue of 'judgement' or strategic intervention is, in our view, less an 'in principle' concern than it is a concern for *when* judgment can most sensibly be made.

On the other hand, software engineers are forced to make judgements regarding what is and is not important when designing computer systems, often with incomplete information. System development is often constrained by cost, hardware availability, memory limitations etc. and it is not possible to address all the requirements identified during the requirements investigation process. In addition, it is common to discover conflicting requirements for computer systems, particularly where different groups of 'end-users' are involved.

The contrast between the two approaches of software engineering and sociology can again be highlighted using an example from the ATC project. We wished to provide an electronic display system to support work currently carried out by a number of activities based around the use of paper based information. Quite early on in the project, it became clear to the software engineers that the mass of information emerging from the ethnographic study had to be structured in some way. It was going to be impossible, given our hardware, manpower and time constraints to address all of the issues revealed. The software engineers asked the ethnographer to try to categorise the activities he was recording in one of four categories:

- An unimportant activity which need not be supported in an electronic system

- An important activity which need not be supported in an electronic system as the activity is a consequence of the existing non-electronic system

- An important activity which must be supported in an electronic system but can be supported in a different way to that used in the current system

- An important activity which must be supported in exactly the same way as the current system

The sociologist's own methodological point of view which treated the system as a fusion of working practices and technology made it difficult for them to draw the distinctions necessary to answer such questions. For example, deciding what were the 'important' activities, irrespective of automated support, was not straightforward. Was 'idle chat' amongst the controllers 'unimportant' and, if so, in what sense? Even though such talk might not be related to the specific tasks of controlling, a case could be made that it was important for morale, the sharing of experiences, providing support and so on.

The prolonged nature of ethnographic analysis

It is not uncommon for ethnographers to spend a number of years engaged in fieldwork and subsequent analysis. Our own study lasted some six months and was itself an extension of a previous study, bringing the total time spent observing ATC to well over a year. It is also by no means clear that the study is 'complete' and that further time spent in observation would not add new information to that already collected. This is a particular problem for the development of 'safety critical' systems where, as was noted in the previous section, situations which occur very infrequently are usually the ones which need to be addressed.

In general, software engineers require information in a much shorter length of time than is needed to perform a thorough analysis, resulting in demands being placed on the ethnographer to provide rapid assessments of his/her work. Traditional approaches to system development require a thorough analysis of requirements before any

preliminary design is carried out. Although a prototyping approach to system development can alleviate this problem somewhat (as will be described later), the use of requirements documents as the basis of client-contractor agreements means that requirements capture and formulation still needs to be carried out as a distinct, initial exercise.

Problems of working together

In addition to the three problems of differing approaches discussed above, practical problems result from the collaboration of different disciplines such as sociology and software engineering. In our view, the practical problems are by far the most important to resolve. One such problem is that of *communication.*

It is often difficult for experts to articulate their expertise to someone not expert in their fields. In addition, both sociologists and software engineers use normal English words as jargon terms. The problem is compounded when the disciplines attach different meanings to the same words or terms. Examples of such terms from our own project which we have found hold different, discipline-specific meanings for the sociologists and software engineers are 'semantics', 'abstraction' and 'model'.

The word 'semantics', for example, is taken as being synonymous with 'meaning' in normal english usage. A problem occurred when the software engineers attempted to define the 'semantics' of an entity using a mathematical abstraction. For the sociologists, 'semantics' were not just dependent on the entity, but on the observer of the entity and the context of observation - semantics are socially negotiated and it is impossible to define them using such mathematical abstractions. It soon became clear that members from the different disciplines were using the term 'semantics' in discipline-specific ways.

Goodwill

The 'sensitivities' referred to in various places in this tutorial gloss the simple fact that learning to 'work together' is a matter of goodwill and mutual respect. Social scientists need to recognise how difficult a task design is, and orient to that fact. It does not help interdisciplinary collaboration when design is glossed as being contingent on the moral or intellectual failures of designers. Our experience is that designers normally have sophisticated understandings of the moral consequences of their work, and frequently agonise over their position in the design space. Equally, designers need to recognise that social scientists, for the most part, are not being critical out of 'cleverness', but are trying in a principled way to provide a different purchase on problems. Talking to each other regularly is the most effective way in which mutual respect is garnered. The de-briefing session, along with the other benefits it confers, is one of the most important ways in which we learn to understand each other.

Addressing the problems using an iterative approach

The problems outlined above have detailed the difficulties for systems developers to use ethnographic data to derive system requirements in a structured way. There does not yet exist a theoretical framework for understanding the interactions between task requirements, the work organisation and the computer system.

It is now accepted that because of the problems of modelling users, and the poor understanding we have of human-computer interaction, it is impossible to get requirements correct first time when developing interactive systems. Attempting to formulate definitive requirements for these systems *a priori* of any design and implementation will result in poor specifications and costly changes as errors are discovered later in the process (Boehm, 1981). This is not to say that specification is

not important in interactive systems design; rather that detailed specification and design decisions should be deferred as long as possible.

The problems in specifying user interfaces for interactive systems has led to the advocation of an iterative approach to requirement capture. This approach is based around two component stages of *evaluation* and *refinement*, where the interface is successively evaluated and refinements made in the light of these evaluations. Development follows this cycle until the interface is considered acceptable, at which point the prototype system forms the basis of the interface specification. This 'HCI prototyping cycle' is presented in more detail in figure 4.1 (based on Draper, 1991).
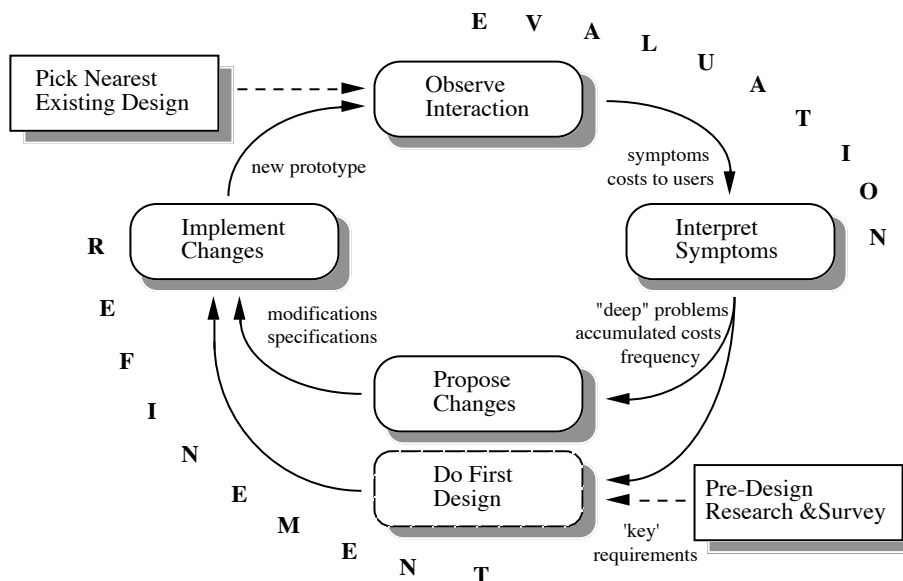

Figure 4.1 The HCI Prototyping Cycle

The nature of ethnographic analysis is one of evolving understanding as the study progresses, with previously held assumptions being confirmed, clarified or invalidated. The time scale involved in developing a good understanding of the social processes taking place is such that an approach to systems development based on rapid prototyping, informed by a progressing ethnographic study, is suitable for the design of systems to support collaborative work. The advantages of such an approach are described by Hartson and Smith (1991) when they say:

"Through rapid prototyping, an early opportunity is afforded the behavioural scientist to build good human factors into an interface design. By building ease of testing and modification into a prototype, the computer scientist is providing human factorability. Rapid prototyping is an important factor in harnessing the sometimes opposing forces of these roles in helping them work together" (page 54).

One approach to integrating ethnographic analysis with rapid prototyping is presented in figure 4.2, which shows the development model for the ATC project. Initially, a generic system prototype was built which reflected early understandings of the application domain. This prototype was refined and new prototypes produced in line with the results of evaluations. During the early iterations of the cycle, the ethnographer was responsible for evaluating system prototypes, allowing gross errors

in the design to be revealed. As our understanding of the application domain grew, it was possible to expose the prototypes to end-users.
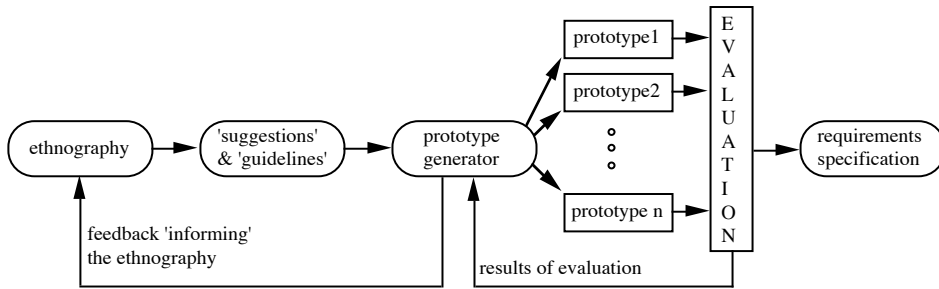
Figure 4.2 Ethnography and prototyping

An important part of this development process was the regular debriefing meetings which took place between the sociologists and system developers. During these sessions, the ethnographer discussed his findings and was questioned by other team members. The system developers' questions focused on the system requirements and, whilst it was rare to identify an explicit software requirement during the debriefing meetings, the developers gained an intuitive impression of facilities required by controllers. At the same time, the developers identified particular areas of interest and problems which should be investigated in the next phase of ethnography. Thus, the ethnographer was informed of the system requirements and focused his observations to answer the questions posed by the system developers.

Our development model utilises prototyping tools to aid the rapid production and refinement of system prototypes. This model of system development, called 'cooperative prototyping' by Bødker and Grønbæk (1991), combines the use of computer-based tools for exploratory programming with user participation in the development process. It allows refinements to be made quickly and for rapid switching between alternative prototype systems.

4. Analytic complementarity

It is already impled in much of what we have already stated, but the point of fieldwork lies, whatever the analytic auspices, in what it provides that cannot be derived from conventional requirements gathering techniques. Even in the case of BPR, which on the face of it has most in common with structured design, the emphasis on the business case is hugely important and historically neglected.

5. Evaluation.

We hesitate to include evaluation as an issue, not because it is unimportant (quite the reverse), but because we feel that the problems of evaluation are quite literally the problems of design. (See Twidale et al,1994) We confine ourselves here to the view that there is a case for 'situated' evaluation largely on the basis that conventional techniques often pre-suppose the parameters for success or failure of a system, ignoring the complexities of organizational change, developing expertise, and so on. One consequence of this is that, in this view, evaluation should not be at a fixed point in the design life cycle but should be ongoing. Purely as a speculation, we wonder how many of the often cited 'disasters' of implementation would have occurred if investigations were not limited to the point in time when systems are procured.

Further, much of what has been said in the literature about ethnographic practice tends to exaggerate or 'over-pronounce' on its character as a sociological method. After all, what we are talking about here is its character as a method for informing design problems. The first and most important point to be made is that 'hanging around is not the point' (Button and King). No method makes any sense whatsoever independently of the analytic functions it serves. Secondly, the character of ethnographic work will, to some extent at least, be altered according to what kind of purposes are envisaged for it.

Developing forms of ethnography for CSCW.

Hughes et al (1994) outline some different uses of ethnography within the design process based on research experience at Lancaster CSCW Research Centre. It does not constitute an obvious *research* typology, such as those that are frequently produced for participant observation studies[1], nor is it mutually exclusive - instead it suggests an orientation to a range of factors that might prove important in the commercial context of systems design such as; available time 'in the field'; the relationship to and temporal features of the design cycle; the overall purpose of study in relation to design; and the availability and suitability of existing data. The emphasis throughout is then on 'design' and the different uses of ethnography within design which they identify include:-
• Re-examination of previous studies: where previous studies are re-examined to inform initial design thinking.
• 'Quick and dirty ' or 'lightweight' ethnography: where brief ethnographic studies are undertaken to provide a general but informed sense of the setting for designers

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[1] For example the common distinction between overt and covert observation or Gold's (1958) typology based on various identified relationships between 'observation' and 'participation'.

.•   Concurrent ethnography: where design is influence by an on-going ethnographic study taking place at the same time as systems development.
• Evaluative ethnography: where an ethnographic study is undertaken to verify or validate a set of already formulated design decisions.

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 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. In this way we are attempting to move away from the misconception of ethnography as simply and exclusively involved in the requirements phase of systems design.

Re-examination of previous studies: The approach to ethnography characterised as the re-examination of previous studies is intended to address one of the major problems that arises when new approaches, new methods, new systems are proposed. That is, the lack experience and a corpus of case studies, examples, exemplars, etc., which can be used as *sensitising* material. Although ethnography is relatively new in systems design, it is a method which has been used for many decades in sociology and anthropology, producing studies related to work and occupations which can be informative. Consequently the re-examination of previous studies takes on some of the characteristics of a preliminary, focused literature review intended to 'sensitise' the research to a range of relevant design issues.

In the case of Hughes et al (1994) they utilised previous ethnographic studies to inform the preliminary design of a Shared Object Service (SOS) platform which, among other things, was intended to handle documents in a wide variety of domains. It was felt that much could be learned by using available studies, even though they had not been carried out with system design in mind, looking for exemplars exhibiting some of the varieties of document production, management and use as socially organised features of the work. Such an approach also offered the possibility of uncovering some properties that generally hold true and consequently this use of ethnographic materials may be especially useful where obtaining sight of general infrastructural CSCW principles is the prime goal. In drawing on various studies of paperwork Hughes et al identify a number of 'sensitivities' for design; the importance of history and record of use within the information store; the prominence of non real-time interaction and the need for effective and dynamic management of access to shared information; 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. Consequently re-analysing ethnographic studies could prove a useful way of sensitising designers to the socially organised character of a considerable variety of settings. Although clearly not a substitute for the more directed uses of ethnography (when there are specific design issues to address) such an approach may perform a useful role in making designers aware - 'sensitive' - of what to avoid and what the more specific issues might be.

'Quick and dirty ' or 'lightweight' ethnography: The phrase 'quick and dirty' - or its currently fashionable alternative formulation 'lightweight' ethnography - 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. 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 might be seen as 'traditional' ethnographic approaches. First, 'quick and dirty' ethnography is capable of providing much valuable knowledge of the social organisation of work of a relatively large scale and distributed work setting in a relatively short space of time. 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 what we call '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. 'Quick and dirty' ethnography is then 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 providing designers with a better sense of the setting and its work activities.

One example of just such a 'quick & dirty' approach, aimed at developing a sensitivity to the work context within which IT changes were to be implemented, is the ethnographic study of a small office reported in Rouncefield et al (1994). Since the setting was so small - a single room with three workers - a week long ethnographic study with follow up informal interviews was deemed sufficient. Despite the 'quick & dirty' nature of the study, the process of work in a small office and its recurrent features; notably the massive volume of paperwork; the importance of local knowledge in the accomplishment of work; and the phenomenon of 'constant interruption'; are depicted and despite the obvious contrasts with large scale work settings analysed in other ethnographic studies, similar features of cooperative work can be observed. Whilst acknowledging the limitations of this study and the obviously mundane or routine character of small office work, we should not ignore the apparent 'typicality' of this setting for many workers and the consequent importance of any lessons learned. Similarly, without being too grandiose, whilst both this study, and the office concerned can be characterised as 'small'; the problems identified may not be; rather they seem generic to the whole issue of the implementation of IT. One particular aspect, highlighted by this study, and likely to be a regularly observed feature of life in many (large as well as small) offices was that of 'constant interruption'. Interruptions, because of their very 'unpredictability' — that is, the fact of interruptions may be predictable but the precise nature of the interruption is unlikely to be — are difficult, if not impossible to incorporate into an idealised model of the work process; which is why they are so disruptive to the flow and progression of work, even when, as in this study, the 'interruptions' are commonly regarded as the 'real work'. If, as we suspect, interruptions are a regular feature of office life IT implementations of the work process need to be sensitive to this 'fact' of office life. What this small study perhaps enables us to see a little more clearly than we might otherwise if dealing with a much larger organisation, is that the shift from a manual system to even a modest electronic one is not merely a shift in technologies but one which involves a change in the understandings, practises and conceptions of work - that system design is work design. The particular issue that this study drew attention to was that moving to greater levels of IT will also involve a reconfiguration of the 'local knowledge' which is essential to the working of the current system. It is therefore important to recognise that embedding a system into work activities, achieving a level of routine-ness, generating relevant 'local knowledge', 'gearing' the user into the work, and so on, are all likely to take time. Consequently the adoption of some element of IT is never simply a matter of switching on a PC the first thing in the morning as opposed to reaching for a pencil. It will also involve subtle changes and adjustments in the sociality of work.
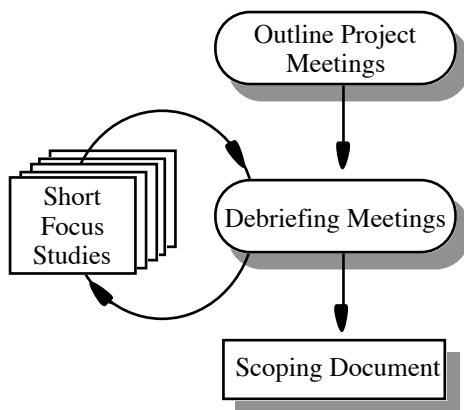
Figure 1: Quick and Dirty Ethnography

Concurrent ethnography: 'Concurrent Ethnography' is perhaps the one most commonly associated with design and the one most commentated on (Hughes et al 1992). It is a sequenced process in which the ethnographic investigation of a domain precedes the design development of the system. This is the method followed in the 'Air Traffic Control Study' (REFS) which was interested in the design of a tool for the rapid prototyping of interfaces for controlling [Bentley et al 1992]. 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.
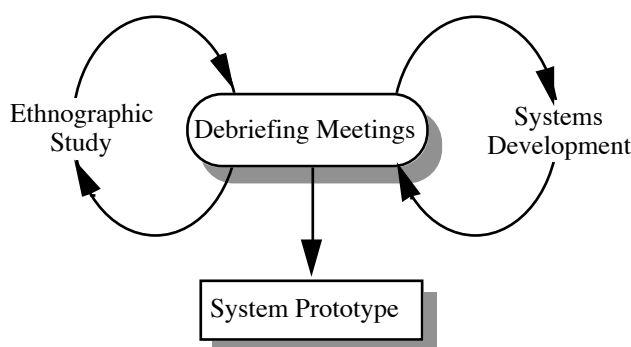

Figure 2 The use of Concurrent Ethnography

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. We also

learned that there was a declining rate of utility for the fieldwork contribution to the design[2], that, 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.

Evaluative ethnography: While undoubtedly 'evaluation' has taken on some of the characteristics of an advertiser's 'weasel word', few practitioners in CSCW would wish to contest its importance, and we have used ethnographic techniques in evaluation in a number of ways. It should be acknowledged at the outset, however, that the evaluation of CSCW systems is especially difficult, not least because of uncertainties over both *what* exactly constitutes an evaluation, *how* it should be implemented and *when* and *where* it should take place.[3]   In particular, in the context of CSCW, as a number of writers have suggested, *"there is a pressing need for the reappraisal of evaluation philosophies and techniques. In particular, the view that evaluation should be regarded principally as a summative process which takes place at a given stage in the software life cycle and which yields 'objective' results is, we believe, deeply problematised by CSCW's interest in the 'real world' context of use. "* (Twidale et al 1994: 441) In a similar fashion Bannon argues that design, use and evaluation should not be viewed as distinct activities, but as being necessarily interwoven and that 'evaluation' issues, informed by the context of use, should effectively saturate the design process.

Based on their experience of evaluating MEAD - a multi-user interface generator tool for use in Air Traffic Control - Twidale et al (1994) document their increasing dissatisfaction with current approaches to evaluation *"it became increasingly clear that although there had been a series of trials of proposed interfaces for actual use in the ATC environment, little confidence could be expressed about their acceptability to the ATCOs. One of the most significant aspects of this was that the proposed interfaces were designed for use in a context where the work itself was likely to change"* and suggest a move towards 'situated' evaluation concerned with the evaluation of systems in use in the context of actual, and potentially changing, working practises.

This implies that a 'situated' evaluation would need to address not only 'technical' issues, the various functionalities of the 'system' and so on, but also a range of 'social' concerns, the flow of work around the system, training, responses to new working arrangements, and more. In the context of MEAD they argue,
 "the idea that evaluation should occur late in the development process, should be concerned with machine or software functionality, and should concern itself with 'objective' results, sits strangely with the concern for the social organisation of work that characterises CSCW enquiry. We were led to question whether systems for use in cooperative work environments can indeed be evaluated for validity in isolation from the work. Significant doubt must be cast on the notion that we can 'validate' a system at a given point in the project if we accept that the use of systems is not completely determined by the functionalities designed into them. There may in principle be a vast range of reasons why usage may vary even within

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[2] This is not to say that there was not more to learn or that we could not have learned more sociologically, only that in terms of the project the 'fine tuning' of the design needed to be informed by experts actually using it.

[3]   Grudin cites the difficulty of evaluation as just one contributory factor in why CSCW systems fail to deliver the benefits intended. Indeed, we may regard all his case studies as examples of a failure to adequately determine what is being evaluated, when it is appropriate to evaluate, and what methods are likely to prove suitable when the focus of evaluation moves from system functionality to system use.

a single organisation. Systems put in place may initially fail because they do not resonate with existing practices. Training failures, the prevalence of 'fear and loathing', the breakdown of new organisational processes and so on may all impinge on the speed with which systems become 'usable'. Equally, tried and trusted systems may begin to fail as changes in the environment begin to impact upon them."

The consequence of this concern and the extension of the evaluation process both in time, from something carried out at the end of the design cycle to something that is interwoven into each of its stages; and in focus, from a concern with purely technical functionality to an interest in the system in use; was a re-examination of the role of ethnographic techniques in the evaluation process,
"evaluation work will have to be conceived of not as something separate from other stages in the design process but as a necessary feature of all design work. Further, substantial re-conceptualisation of the notion of the 'system' and its boundaries will be necessary if we are to be serious in our attempts to evaluate use" ... With the admitted benefit of hindsight, we came to feel that all of the ethnographic work undertaken during the course of the project can and should be regarded as ongoing evaluation, proving useful in various ways at different stages of the design of MEAD, and in principle in systems development at large."

'Evaluative' ethnography can also be considered as a more *'focused'* version of the 'quick and dirty' approach in that while it does not necessarily involve a prolonged period of fieldwork, it can be directed/focused at a 'sanity check' of an already formulated design proposal; that is, it is used in evaluating a design. The example we use 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 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.
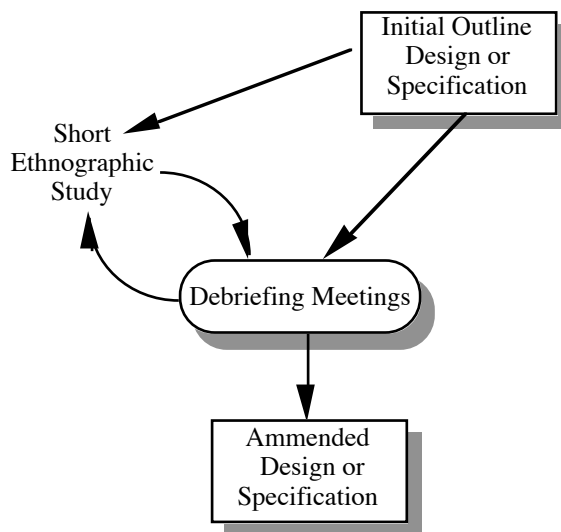

Figure 3: The role of evaluative ethnography

Whilst only a very brief characterisation of the results of the ethnography; the findings 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, the problems are to do with incorporating ethnography into the system design process in order to improve system design while recognising that this is 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, which is reinforced by the findings of Twidale et al (1994), 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.

This use of ethnography may be 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.[4]

The practical problems of ethnographic inquiries

Although it would be wrong to portray ethnography as the main method of sociological research, over the years such researchers have gained a great deal of practical experience of the problems in using the method. It is important that these problems are considered when both planning and undertaking an ethnographic study. These section briefly reviews some of the common problems associated with doing an ethnographic study in order to inform the development process. These are not the sole problems associated with the organisation of a study but are illustrative of the problems which most commonly effect ethnographic studies.

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[4]   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.

Access

One of the main problems of organising an ethnography study is access. This is really a cluster of problems which include gaining entry to the work setting, gaining acceptability, being able to 'hang around', and more. They also include problems that might arise from sponsorship and association with particular vested interests. Even if entry is successful, some areas might be regarded as 'sacred' and off limits to the observer. In any organisation there are likely to be gatekeepers who can block off access. In an organisational context these can include different managerial sections, secretarial staff, 'shop floor' workers, and more. In other words, gatekeepers are not always the high status members of an organisation; quite the contrary. There is also the question of whether the ethnography needs to be 'open' about the purposes of the study or clandestine. In the context of CSCW, even when invited into an organisation, this can present problems vis a vis other groups within the organisation. Oddly enough, a reverse gate keeper function is often recognised by ethnographers, in which people being observed insist on determining your focus of interest on your behalf. It is good policy to go along with this, since failure to do so can result in a loss of goodwill, even though this sometimes means time will be 'wasted'.

The role of the fieldworker

Entry into a natural setting will inevitable mean that the fieldworker acquires a role which will be interpreted and understood by organisational members in particular ways; a role which may have effects on how forthcoming they may be, acceptability and access. In addition to that of researcher, one valuable role is that of the 'novice', the 'incompetent', who is licensed to ask naive, even stupid, questions and, thus, explore much of what is tacit to the experienced member. (Dave Randall in the ATC study had to be told that the reason that the clock in the Operations Room was 'wrong' was that ATC works to Greenwich Mean Time, several months into the study). Arguably, this requires a particular kind of fieldworker- one who is comfortable with their own lack of understanding. Most ethnographers would agree that there are distinct psychological phases in the conduct of a study, ranging through:

'everything's really interesting'

'I don't think I'll ever understand this'

'ah .... right ....'

'this is really boring'

'I've not seen that before'

It is as well to recognise that one goes through these stages, in that it pre-empts a loss of confidence on the part of the fieldworker. An additional benefit of this stance is that subjects become aware of the fieldworker's developing expertise over a period of time and gear their responses to what the fieldworker 'knows'. One danger is that the fieldworker may become so enculturated in the setting that he/she 'goes native'.

These issues apart, one important aspect is that the fieldworker must gain credibility which may include, depending on the type of organisation, working the shifts, putting up with the conditions in which members have to work, and so on. In addition, a non-intrusive demeanour is important without being too self-effacing. It is also important to pay attention to dress codes and generally observe the properties of the setting.

Focus of the study

A key issue of ethnography is that of focus: what is it one is going to look at? Broadly there is a choice between the 'innocent' ethnography and the 'informed'. In the former, the designer's concerns are not taken on board, whereas in the latter observations are much more explicitly determined by the designer's concerns. Our own preference is for the 'innocent' ethnography. Organisations are complex. One does not know in advance of inquiry which aspects of organisational life will turn out to be of interest and importance for work. In other words, the priority is to gain a good sense of organisational life before trying to address issues of design. This does not mean that such issues are irrelevant; the matter is one of scheduling. That is, to adequately inform design and its possibilities the ethnographer, in our view, needs to construct a portrayal of the 'real world' character of the work concerned in order to properly address questions about what can be supported and what cannot. In this respect it is important to effect a dialogue between the ethnographer and the designer so that, over time and beginning from 'innocence', the design can be gradually and informatively be developed in light of a description of the 'real world' character of working life.

Making Notes:

Below is an extract from fieldnotes from observation at the London Air Traffic Control Centre:

7.30

Chief: 'Bloody Whiteair's going up'
[It is entering controlled airspace despite not having been cleared to do so.]
'.... I told them to keep him ...'
Points to it on the radar display.

Chief 'Those bloody Danairs are running together ...'
Points to to planes coming South.
Chief '*'s both planes on relevant strips to indicate that both
are at 270 (27000ft) and 3 minutes apart, travelling in the same
direction.

Chief on telephone: 'why have we been given the Logan? ... he
only wants 14 (14000ft) ... ah well, you see we haven't got the
strips ... give him back to you?'

The suite is busy. The controller '*'s two more strips, and
headings written on them. [planes are said to be put on headings
when they are asked to deviate from standard routes]

Two planes are due to arrive at Barton, another reporting point
at the same time and height.

Chief to Controller PH: 'Watch these two buggers.'
Chief points at strip rack.
Chief says to incoming chief: 'Those two are dead ringers.'

Controller IS: 'Right ... where's the 7Romeo?'
Looks at radar screen. [The strip is cocked, indicating attention
needs to be paid. There is a potential confliction with an
inbound Oceanic flight]

8.00 Controller hands piece of paper to wing, with handwritten
information he has received by telephone from Scottish Control.
[Normally, this would have been done by a direct telephone to the
wings by Scottish] This information is input by the wingman so
that a strip can be printed out.

8.50
Chief to Chief (telephone): 'BEA888 ... he's climbing very well
... for a 111 ... could make 27 at Upton ... that OK? ... and
cleared for 35? ... yeah'
Chief to Controller: 'OK ... 27 ... and 35 later ... OK? ... it's
approved'
Controller writes 270 on strip.

We can make a number of observations about these notes and the analytic work being
done with them:

1. The notes are pre-organised. The ethnographer has clearly left out whole passages
and begun to organise the notes as 'showing something'. Nevertheless, they are more
or less incomprehensible to the inexperienced reader. They contain a number of

technical terms and rely on the reader having some prior knowledge of 'what is going on'- in all probability only the ethnographer has that knowledge.

2. The ethnographer is making some attempt to characterise each vignette as being an 'example' of something. We have here, if you like, some early indications of what he feels might be significant issues.

3. Though opinions are expressed, the bulk of the notes contain examples of behaviour. Here, most of this is in the form of descriptions of conversation and movement. Note, however, that there is none of the precision that one associates, for instance, with Conversation Analytic work. Decisions have been made about the appropriate level of granularity. Observations here are not 'fine grained' in comparison to, for instance, Heath and Luff in their video based analysis of a London Underground control centre. They presented data at a sometimes very fine level of granularity, including close analysis of gesture, eye movement, and precise conversational analysis. Whilst in no way wishing to critique what in our view is a very fine piece of ethnographic observation, it is necessary to point out to the inexperienced practitioner that there is no reason to *presume* that such 'fine grain' analysis is the appropriate method in all domains.

2. The analytic auspices under which enquiry will take place can be very different. In our view, considerable confusion arises over the significance of analytic stances such as ethnomethodology and Conversation Analysis, and their relationship to ethnography. At the risk of stating the obvious, there is a very considerable difference between an analytic standpoint and the practice of a method. Suffice it to say that the kind of ethnographic work typically done in HCI and CSCW is strongly influenced by the perspectives we outline above.

Asking questions.

Some purists, who advocate 'fly on the wall' approaches to ethnography would argue that asking questions is an intervention in the natural domain and thus produces bias. We do not accept that view. Asking questions is an important and necessary way of gaining understanding of the domain in question. Even so, a number of practical issues arise:

1. Knowing what questions to ask

One of the general critiques of knowledge elicitation is that the knowledge uncovered is in part structured by the kinds of questions asked in the first place. It is certainly true that subjects will provide responses which are designed to answer the question in ways that are relevant to 'what they think the question is about'. They will make such judgments, of course, on the basis of what they know about the person asking the questions. It means that they will leave out matters which they do not consider relevant. For this reason, asking questions *early on in research* should not be done with a view to getting serious answers. While helping you 'get a sense' of the domain in question, it is unlikely to provide you with the answers you are seeking. The point at which questioning becomes a worthwhile entreprise is the point at which you know enough about the domain that you can begin to ask questions you know to be relevant.

2. Discretion is important. In safety critical domains such as ATC, it is obvious that sometimes asking a set of questions is unlikely to be welcomed at the wrong time. Equally, of course, and of particular importance in 'real world' arenas, it should be recognised that you 'don't frighten the horses.' That is, you do not unnecessarily produce uncertainty and fear in the people in the domain by asserting that the results of your study might, for instance, lead them to lose their jobs. This may seem

obvious, but anyone who has practiced out there in the "real world' will attest to the extra-ordinary insensitivity of the occasional practitioner.

3. Reliance on the answers. Don't get obsessed with issues such as questionaire design. One of the problems for the 'tyro' researcher is that they are inclined to believe that there is some 'right' way of doing things, and are inclined to read the literature with a view to finding out what it is. Doing this with the sociological literature is likely to lead one to the view that questioning is a complex matter where issues of reliability and validity are extremely important, and only to be arrived at by correct questionnaire design. Our own view is that sociological methods are 'overengineered' for CSCW purposes. The fieldworker will learn what questions are important, how reliable the informant is, and the contingency of responses in the course of the work.

Related to this is what to do with the answers. There is a tendency in both sociological and psychological literatures to produce aggregated responses, ie. Statistical distributions of response. While this may be valuable for some purposes, it contains one significant danger in the CSCW context, and that is that it may well be that the interesting problems are to be found in uncovering *the significance of different responses*. Again, we believe that getting a good feel for the range of different responses to particular questions is a useful exercise- more so than subjecting them to statistical analysis with a view to arriving at consistency. In this respect, the ethnomethodological injunction to **treat all accounts as versions** is invaluable, even if one has no sympathy with ethnomethodology. Again, the important issue is to do with the point at which one begins to favour one account over another.

Duration of the Study

Ethnographic material presents designers with a large amount of rich and discontinuous material among which designers have to select. For the ethnographer this issue is presented as one of completeness; when is enough, enough? In sociology and anthropology ethnographers have spent years on their fieldwork; a time scale which is excessive from the point of view of system design. While there is no firm rule about this, there is a rule of thumb which can be useful, namely, the flattening of the fieldworkers own learning curve. The fact that the social organisation of work, as with many human activities, has a routine and format to it, means that the effective ethnographer is able to grasp, within a relatively short period of time, the key aspects of the work. However, it is also vitally important to recognise that key aspects of the work may not be routine but exceptional. Knowing how work is ordinarily done is not sufficient for designers. Knowing what problems occur, how frequently, and what their significance is, how they are dealt with and with what degree of 'competence' can provide very useful information. Nevertheless, this poses the practical problem of how the ethnographer knows that the ethnography is 'complete'. There are know self-evident completeness rules. As a rule of thumb, however,

a. the flattening of the learning curve is an indication of adequacy, at least in terms of 'ordinary' situations.

b. Knowing what you haven't seen is a further test. For instance in the ATC research the bulk of the research took place in the Winter months. Given that controllers constantly made reference to how busy it got in the summer, it pointed to a need to return to the domain. In the same research, the ethnographer never saw a disaster, but did see some 'air misses'. This provided a useful baseline for assessing exceptional events. Knowing what you haven't seen, often by letting participants describe other ecents to you, and reporting it to designers, can be a very useful indicator.

The Analysis of Ethnographic Data

As we have seen, there are a number of competing analytical schemes that will inevitably influence the way in which the data comes to be 'seen'. In our view, and we have always tried to be consistent in this, the main danger with any analytical scheme is that its theoretical interests can determine the structure of the data from the outset. We feel, and most of the frameworks we have looked at allow, analysis should evolve from the particular problems that arise from the domain in question, not least because the theoretical auspices of the work are unlikely to be of any great interest to the client. It is for this reason that increasingly ethnographic data has to relate to the human resource and process issues which are the client's concern (outside of purely academic research), and why we have attempted to highlight those relationships wherever possible. We cannot stress too much that system design had developed a purchase on process, or the 'formal' aspects of work with computer systems, long before the advent of CSCW, and ethnographic research cannot be defended as a superior set of techniques for understanding data structure, data flow, process boundary, or what have you. In all of the perspectives we have identified, and to varying degrees, with different emphases, it is possible to see what prolonged ethnographic work can confer on our understanding of work. It is in the relationship between idealised conceptions of process and data and the ordinary 'lived reality' of task, work, organization and political experience, that the power of ethnography is to be found. To put it another way, lengthy descriptions of organizational cultures, in and of themselves, will not provide a 'better' solution to organizational and technical problems. Understanding how they relate to matters that system designers have always concerned themselves with, arguably will.

Below, we discuss some categories that we have used in different contexts, and which hopefully demonstrate the way in which this relationship can be clarified for designers. The important point for us is that these categories can be disposed of at will- they are not intended to be a means to organize new data. They are simply 'conveniences'.

1. The Ecology of the Workplace.

It is our contention that the spatial organization of workspaces often turns out to be consequential in accounting for how work is possible. In one sense, there is nothing new in this. The Office Automation literature, for instance, is replete with spatial metaphors of one kind or another. Nevertheless, we hope to show that an ethnographic 'take' on problems of spatial organisation is rather different. If not a particularly radical form of observation, detailing the spatial distribution of artifacts is, in our view, a necessary preamble to other analytic work. Concepts such as 'ecology' are illustrative *both of the resources that people bring to the accomplishment of work activity and potentially indicative of ways in which new technologies can sensibly mediate current practice.* Some colleagues at Lancaster would go further and argue that descriptions of layout etc should be visual. The point is not that exhaustive decriptions of the environment are either interesting or necessarily illuminating, but that they can be indicative of the way in which space must be organized in order that *work* can be effectively organized within the

constraints of the current system. Therefore, descriptions of the physical environment should orient towards ways in which it matters to the work. Thus:

Example from ethnographic report

"What follows, then, is a brief description of the typical geography of the work environment, referencing in particular the locations of file stores, useful information, and the way in which individual cashier's deskspace can be organized.

Notionally, at least while completing the routine transactions that take up a large part of the day, cashiers sit in parallel with a computer terminal of relatively small dimensions immediately between each cashier and the customer, and with a printer situated between cashiers and used on a 'one between two' basis .....

In addition each cashier has a three tier set of drawers in which are kept variously, cash, withdrawal slips, stationery, and so on. In other words, the most commonly used materials, unsurprisingly are kept 'to hand'. Significantly, and for the same reason, each cashier position is surrounded by notes stuck to walls, etc. *which contain 'at a glance' information, most of which relates either to various codes for use with the system, or to information which customers commonly seek.*
Of equal significance is the existence, depending on branch size, of a number of phone lines, on which cashiers both answer enquiries and make enquiries of their own where appropriate. There is a universal recognition of *the need to both answer the telephone promptly and deal with customers expeditiously ....*

The fact, however, that the combination of both information available through the computer terminal and on paper must be used, on many occasions jointly, allied to necessary recourse to the telephone both to receive and make calls, means that counter to one's intuition, cashier work is by no means static work. *Mobility in and around the office space is a normal feature of day to day working. This is almost always the case with the more difficult enquiries and transactions, but is to some extent true even with more routine matters.*"

[Italics added]

Here then, we begin to see some significant differences between standard spatial metaphors and the work of ethnographic analysis.

2. The Flow of Work (not Workflow.)

In addition to spatial factors, ethnography for systems design should concern itself with the realities of the flow of work. Given the development of a business literature which is very much concerned with the monitoring and management of Workflow, the notion of the Flow of Work takes on a particular resonance. Our concept of the flow of work is intended to be contra-distinct to the concept of workflow. Our interest lies precisely in those areas that in our view Workflow has not hitherto been designed to analyse. That is, we are interested in describing work with all its contingencies: Interruptions, good and bad practices, seeking help, making mistakes, and so on, rather than picturing work in terms of an idealised conception of how it ought to flow.

a. Orientation to Procedures.

A number of points can be made about this:

1. Ethnographers are just as interested in procedures, processes, rules, etc. as any more formal analyst.

2. Ethnographers have no particular skills, arguably less than the process- oriented, for providing detailed accounts of what these processes are.

3. The value of the fieldworker's knowledge lies in recognising the 'gap' between the process and the way things are actually done.

4. The contingent application of rules and procedures usually happens because operatives have discovered this is 'a good way of doing things'- ie solves a problem. Never assume the procedures are not being followed simply because workers 'can't be bothered'.

Descriptions of procedures must be in the terms that the client organization will understand. For the most part, this means using the terms they use. There would be little point in an ethnographer detailing every procedure adopted in an organization, because a. procedures should in principle already be known to the organization; b. because if the logical underpinning of the processes is at stake, then some variety of logical process modelling will almost certainly be a better way of deriving this information; and c. because the analytic interest of ethnography should lie precisely in the difference between formal descriptions of procedure or process and how they are actually carried out. Organising data in such a way that the formal processes that are described either in organizational procedures or in process modelling that has been undertaken can be recognised is directly useful for comparison purposes. In the study which we undertook for Digital organizing the data in this way enabled our conclusions to be be compared directly with 'bottom level' processes described in a prior business process 'model'. There would be little point, as we have said, in recounting every process, and the view we took in this study was to mention processes we had observed but record details only of those processes which appeared to warrant close investigation either because they contributed to the 'routine troubles' of the work, or because they are indicative of social factors without which the work could not be accomplished.

Example from ethnographic report

Opening new Accounts

The procedure for opening new accounts is strikingly time consuming. The first point to be made is that new account numbers are currently allocated in sequential order from a ledger containing those numbers. There seems no obvious reason in principle why account numbers should not be automatically allocated.

As already noted, the process is compounded when customers seek to open and possibly close several accounts- a not unusual event, especially when accounts are being opened for children/grandchildren.

Of course, different accounts require different inputs. Having received the two Application Forms required by the Society from the customer
[" We keep one for the files, and one goes to Head Office ...." I am aware of no reason why such information cannot be electronically transmitted], if a passbook is involved, the cashier must issue the new passbook, obtain the next Account Number from a sequenced file, and then type in the Account Details on the Static Investment- New

Account screen. Depending on the account, different codes have to be input governing frequency of interest payment.

"Once you've got the Static in, it'll print it for you front and back on the passbook ...." Passbooks are retained when the account is opened by cheque, for a period of 10 days. A separate Static printout is also generated and filed, along with the completed Application Form.

Inputting information to the Static Display is probably the single most time- consuming aspect of the whole process. Within reason, cashiers will sometimes leave this work until the customer has left rather than expect them to wait for unnecessarily long periods. This is, however, a technical breach of procedure, in that,
"We're supposed to get the customer to sign and check the headers ... and they get impatient cos they're having to wait while you put it all in .... and the number of times you get communication failure and have to do it all over again ...."
but is done for practical reasons surrounding customer confidence. Thus,
"I had a man in last week who wanted to open four accounts ... I just had time to get them open ... there was a queue right out the door .... there was no way I was going to get the Statics done ...."

The point is that various approaches to the business process tend to start with the way in which 'events' prompt process. These events can of course be typified and codified in such a way that they in principle provide for a logical sequence of operations to deal with each contingency. Observation shows however, that there are at least two ways in which this logical flow is in reality disturbed:

1. The 'events' which precipitate a process can be compromised by customers who do not in various ways meet procedural requirements. In the extracts given above, for instance, there are examples of customers who wish to open several accounts, and customers who does not have the right signature.

2. Customers do not deal in one event at a time. In particular, as we shall see below, customers tend to use a straightforward transaction as an opportunity to raise other matters.

b. The Egological principle.

The egological principle refers to the way in which work is organized by the person doing it. It is thus quite different in analytical purpose than conceptions of work organization which analyse according to managerial intention. A common sense way of dealing with the egological principle is to examine work according to the questions participants might ask themselves as they do work, notably, "What must I do next ?"

Our studies of the financial sector, for instance, raised the issue of customer services in a quite different way to that raised by Business Process approaches. For the cashier, the concerns that dominate decision making are the length of the queue and the problem that the next customer brings with them. That is, the queue must be kept flowing, because customers who have to wait become dissatisfied, but at the same time each individual customer must have their query dealt with to their satisfaction. This may on the face of it seem obvious and straightforward but is less so once observation makes the sheer range of queries apparent. In other words, customers introduce a very high level of unpredictability into the flow of work.

Example from ethnographic report

"That customer asked if two cheques had gone through .... one for £120 and one for £105 ... we try to discourage it cos it takes so much time ... we used to just print it out

but the customers just asked more questions, like what's this ? ... when it's an interest update ...."

Customer wants to know what a £15 Direct Debit is for.
"Is it Direct Debit or Standing Order ?"
Cashier rings Banking Services, saying to me "Standing Orders I can bring up on the screen but Direct Debits I have to ring ...."
To customer: "Its British Gas ..."

Further, for a variety of reasons, every customer query cannot be dealt with 'here and now'. The query may be so unusual that no procedure exists for dealing with it; so time consuming that to follow it to its conclusion may mean an ever lengthening queue; or the information available may not be adequate to provide a solution.
The cashier must 'weave' interaction with technology into the flow of interaction with customers in a queue and in such situations a technology which ideally should be 'invisible' becomes all too visible when it cannot provide the appropriate data.
In any event, it is not merely a question of the rational completion of a process, but engaging in demeanour work which convinces the customer that everything that reasonably can be done, has been done, and finding ways to send the customer away satified, perhaps with a telephone or postal answer.

Ethnographic observation, thus, would concern itself with how 'what this customer wants here and now', not what the computer system is structured to do, because it is the former which determines what the cashier will be required to do next. This has more than a little significance for the user interface. If one finds, as indeed one does in this 'customer facing' work that the information on available screens is not adequate to solving customers' problems, then there are lessons for the organization of data on the screen to be learned.

Understanding the character of interruption in this context is also dependent on the ways in which the work is 'customer driven'.   It is work activities which do not include customers that are frequently interrupted. They have to be 'picked up' and 'put down' as customers appear, and cashiers will routinely complete each other's work as and when they are free to do so. The often informal ways in which work is completed by several people acting together we refer to as the social organization of work.

c. The Social Organization of Work.

This concept recognises the fact that very little work in an organizational context is ever done in isolation. (In this respect it bears some similarity to what Hutchins refers to as system properties) That is, even when the person doing the work is physically isolated, doing the work will normally involve an awareness of the work other people are doing or might do. That is, and to over-simplify, 'who's doing what' is an important organizing principle of working life. This can be manifested in some very simple forms, as with casual questions to colleagues, where that awareness is constituted in knowing that there is someone else who might be able to resolve your problem:

Example from ethnographic report

*Cashier 1: "What do I do about this *** account ... it's got nil written on .... you can't open an account without any money in it, can you ?"*

Cashier 2: "It's Mr ..... just put it to one side until he pays the £100 ..... he's got over £30,000 in his other account .... don't actually open the account, just hold it .... he doesn't want to open the Norcash account unless he gets the Mortgage he's applied for ..."

Mortgage processing is manifestly a cooperative activity, at least in this branch. Files ready to be 'sent upstairs' are always checked and the deployment of highly specialised knowledge becomes most evident during this checking process. Two brief examples demonstrate this:

"Flats like these ... it's usually a situation where one of them holds the freehold. You have to have a Special conditions that the freehold applies to, say, Flat 1 ... "

"This isn't a tax reference ... it's a personal tax number .... if we send that to the Inland Revenue they'll just send it straight back again ... we'll have to ring him ...."

Experienced members of the team are a resource for the less experienced and for those undergoing training. Policy is decided on the basis of the mutual deployment of knowledge:

Cashier, having dealt with a mortgage enquiry over the phone:

"that's the trouble with the Repayment ones .... you've got to take the Tax Relief off, take the discount off .... and when you don't deal with them every day ...." Where a team is at work as in the *** branch, solutions are often quickly found by the pooling of expertise:

"If the advance is dead on 90%, would you times it by three or by 2.75?"
"Does she need to have a multiple of three?'
"Yeah, it's dead on now ..."
"Put it in as 89 then and times it by three ... you're alright .... just ... doing it by 2.75 .... do it by 2.75"

It can be exemplified by some rather more oblique considerations, as in the fact that in many areas of work it is important to let other people know 'where you're up to' and this is certainly true of financial services. The contingencies of working life mean that, for instance, customers may make enquiries to people other than those who are dealing with their 'case'. This leads to a fairly common practice in work which involves annotating files, forms, etc. so as to indicate for other potential users of information what has been done and what remains to be done, as with:

" The survey shows a lot of problems. We need to get in touch with Mr .... and tell him about the damp. He may not wish to proceed. Kathy."

This simple fact of working life, however, is still largely ignored by systems designers (although 'flagging' work done is a feature of some more recent CSCW systems). It is equally not something that Workflow management appears to take seriously. Indeed, ethnography has much to tell us about the rationalist model of work contained in Workflow analysis, and some of the realities of cooperation. The fact that work is often 'picked up' and 'put down', often by more than one person; that the necessary artefacts have to be kept handy as visible signs both that 'there are things that need completion', and so we know where the necessary documentation for that completion is to be found; and that often the work can only be completed with the assistance and knowledge of others are important to notions of Workflow. Some of our studies in the financial sector have raised other issues concerning Workflow, including the overhead involved in maintaining information,and its applicability to work activities that are less routine:

Example from ethnographic report

As was noted in our initial report, the work management programme seemed to generate a considerable, possibly disproportionate,amount of aggravation and cynicism- the suggestion being that the process failed to account for factors such as interruption, error, or fatigue. Management attitudes to *** were, at best, ambivalent .... ackowledging that the further removed from routine processing the more difficult it is to have any confidence in the efficacy or widespread application of ***. Ironically, given the emphasis on 'selling', it is in Sales that *** is of least value:
"You don't know whether it's going to take you ten minutes to explain the product and sign it up to the customer, or an hour and a half, it depends on their prior knowledge ... and there's no such thing as selling one product to one customer ... you go through the whole range of products you've got available and then pick out what you think is the right one ... and *** is just not suitable for that."

d. Skills and Expertises

Charles Perrow was the first organizational theorist to produce a conception of technology that had to do with its use, and one of the critical features of enquiry into work under the auspices of CSCW concerns skilful or discretionary work, particularly in the use of systems. The value of ethnographic methods, and the sociological focus implied by them is that they encourage us to view outcomes in work as features of both technologies and the skills which go into using them. That is, without the sociological focus there is a tendency to view process outcomes as wholly a product of the functionalities of the technology. The skills which allow those functionalities to be realised can otherwise go unrecognised. Equally, the limits of skill, perhaps because training has proven inadequate or because of the complexity/ rarity of problems, may tell us much about technical support needed or human- computer interactional difficulties. Skill, of course, is only relevant if it is employed in pursuit of objectives which are consistent with those of the 'official' organization'. There is little point, therefore, in merely describing skills, because what is important is whether those skills are necessary to efficient and effective practice. Thus, a major analytic focus of ethnography is the deployment of skill, and particularly how that skill relates to the business objectives of the organization and to the effective deployment of technology within that context. That is, decisions about appropriate technology must relate to the value of the skills that are used. Nevertheless, and it is an important point, understanding the limits of skill vis a vis technology is only possible if we have adequate descriptions of the skills in play in the first place. Those descriptions may not otherwise be available to decision makers. Our own experience suggests management often has only the most glossed understanding of the skills necessary to the completion of work tasks.

In the Building Society study, as we have already shown, it was quickly apparent that one element of skilful work was interaction with customers. These skills were manifest not least in their interactions with customers, their ability to find their way round a fairly unfriendly database whilst so doing, and their mutual co-operation in solving routine and not-so routine problems. All of this took place in a context where they are required to engage in demeanour work which is itself very skilful and without question has to be learned. It is often evident in what on the surface appear to be small matters- learning the right 'pitch' for the voice when conducting transactions behind bullet-proof screens, learning to maintain customer confidence in response to difficult enquiries, learning to interact with technology whilst at the same time maintaining customer flow unproblematically, all on top of the standard requirements of the job of work, that is, being able to process transactions efficiently and with a minimum amount of error. Skill is obviously dependent on the specific work context, and it is difficult, not to say impossible, to generalise about the skills that are likely to be found in a given domain. Nevertheless, certain pointers are available which orient us toward aspects of skill which otherwise do tend to remain 'invisible'.

Local knowledge.

Process oriented methods such as BPR are of course based on approaches to standardization. There ought to be no surprise in this, because standardization has been an objective since the time of Taylor. However, there is, of course, a rather important issue at stake in that it may well turn out to be the case that there are limits to how far standardization can be successfully implemented. Indeed, our own observations have shown that, for instance, even in environments where standard business processes are in operation, local differences almost inevitably arise, which have to do with the distribution of resources and, more importantly, local knowledge. In other words, where it may be presumed that it is the processes that are producing efficiency, it may be that it is only in conjunction with local knowledge that tasks can be efficiently performed. This is not an argument against standardization, but against the simple presumption that it is standardization alone producing the business rewards. Local knowledge can, of course, take an almost infinite number of forms but would certainly include knowledge of local aspects of the business operation; local aspects of the environment; and knowledge of the distribution of knowledge and skill through the organization ('knowing who knows'). It is an almost universal feature of white collar work that knowledge of this kind is pasted or stuck around the work space, for instance on 'post it' notes.

Some of this knowledge is often in semi- codified forms. Thus, the existence of 'bibles' is well known to ethnographers - files, books, or what have you, in which individuals keep large amounts of information which are relevant to their work and not readily obtainable elsewhere. 'Bibles' are very useful resources for an awareness of the information that operators find useful but is not always recognised by the organization. It does, of course, raise the issue of whether databases can usefully be structured so as to provide this kind of information. Operators, for instance, often recognise that such information could be available electronically and that the issue for them is whether the overhead is greater with an electronic version that with paper. Thus:

Officers universally:
*".... carry these mortgage bibles around ... and other policies ... then there's products and handy info like the thing that's on your crib sheets ... marketing initiatives and competitions. All this could be on the screen. You could have your frauds, like your dodgy solicitors and accountants, telephone lists and other useful info, **but we want it all organized so you'll use it.**"*

Equally, it is a feature of local knowledge that some people have more of it than others, and it is always interesting to see how certain individuals are commonly recognised as local experts to be used collaboratively (see data on the social organization of work).

The existence of local knowledge, and its differential distribution across the organization, has potential consequences for policy decisions which relate to human resources issues. For instance, one of the issues that is commonly discussed in many management strata today is that of devolved decision-making. HRM generally advocates the devolution of authority to locales, but the extent of local knowledge is clearly relevant to this, in that if decision making were devolved to individuals who were not party to local knowledge, nor had a means to access it, problems might arise. On the other hand, the value of devolution is held to be considerable economies of reduced time and less duplication of effort. If devolution were a strategy to be adopted, it would suggest the nature and distribution of local knowledge might become a requirement for a distributed knowledge base.

Example from ethnographic report

As a mortgage advisor in one of the branches put it, "When you get one that you've never come across before, well, I was always taught to go to the expert .... we know a little bit about everything ... but like I got one where someone wanted to borrow money to buy land ... and I couldn't find out ... you can't go to Mortgage Applications any more ... [?]" The theme was reiterated by another:

"You always come across these that you've never heard of before. You always go to the expert ... that's what you've heard all through your career." suggesting that the knowledge base outside of these locales is a fragile one, and that careful steps would need to be taken to develop both the necessary skills and confidence, without destroying a resource which is currently valuable. It is interesting to compare views of the mortgage process. On the one hand there is an eagerness for empowerment: "We're supposed to send all mortgage enquiries to the advisors ... we shouldn't have to ... there's some we can handle."

Equally however, "A lot of time and emotional energy is spent on berating people who get things wrong ... you know, like leaving out codes on forms, miscalculating premiums, incomplete Miras forms and suchlike." and the comment that, "we don't always have the time ..." suggest some reluctance.

Additionally, "There's no permanent staff who really know their job inside out ... we've too many people doing a bit of everything ... with this one, the client has been sitting there for days waiting for the valuer because the instructions got sent to the wrong address ...."

These comments would suggest that there are aspects of the Society's culture which are implicitly hierarchical and that results in a general lack of confidence in ability to deal with the out of the routine. Devolving is a change management problem of some sublety. It resides in a great deal more than simply replacing highly localised specialists with a more diffuse structure of responsibility. There is little question in my mind, however, that the chances of successful implementation of such a policy would be greatly enhanced by a computerised knowledge base that was responsive to the needs of it's users, was easy to use, and which perhaps offered users the opportunity to build new knowledge into it.

Obstructions to problem solving.

Ethnography would be a very conservative procedure if it did not find ways of reporting on problems in current work scenarios. As we have stated above, however, there are many ways of specifying problems. Using some of the organizing concepts we have already mentioned, it is possible to identify ways *in which technology and problems of work* rather than process are interwoven. As we have tried to stress, it is by no means clear that objectives are always met because procedures or technologies exist. Sometimes we may discover, if our analytical focus is work, that the skills of human beings are compensating for inadequacies of procedure or technology, without there being a general awareness that this is so. This is evidently an important point in the evaluation of technologies, and not one that can be readily dealt with by other methods on their own.

In some instances, problems are relatively easy to identify, simply because it occasions a significant amount of frustration on the part of operators, or 'headless chicken' behaviour where there is a great deal of running around to little effect.

Example from ethnographic report

A large part of the day is spent responding to queries, and answering the phone is a priority. It is in these circumstances especially that the difficulty of tracing the

whereabouts of files becomes most evident. The file-chasing aspects of the work are compounded by the fact that the office receives many queries after the customer file has left for Mortgage Applications, or indeed beyond. The reason for this, as the Office Manager put it was, "They always ring us cos we're the ones who interviewed them ... and one of the problems is trying to find out where applications are ... trying to chase them ... you can spend 5 to 10 minutes making phone calls. your first stage is always to ring Wordplex"

Excluding interview time, some 10-15% of officers' time is probably spent in establishing where relevant files are. Some suggestions are made in the concluding section of the report.

"When mortgages are complete, we've found that a lot of times people forget to make their initial payment ... in this case he had paid, but to the wrong account so I'm writing a Memo to Mortgage Admin."

The necessity for this kind of corrective work seems to be something of a serious problem. There seemed to be a number of cases of customer confusion arising from, in particular, the initial payment. The solution to this would seem to lie above all in clear communication to customers, rather than in radical surgery on procedures of rectification. Nevertheless, there are features of the work which could be enhanced. Firstly, it is claimed that customer accounts are difficult to read to such a degree that the first line of defence- the cashier- has no direct means of knowing whether the account is in arrears or not. As one officer put it, "A particular problem is customers wrongly in arrears. It generates a lot of customer dissatisfaction ... . and then when customers are in arrears it's not recorded on the system ... the cashier has know way of knowing whether the payment is in line with the arrangement or not ..." It should be noted that this is a problem for all those who have direct dealings with customers. Following the long extract in Appendix 1, the following conversation took place:
"It's so time-taking ... even on the cash desks ... customers get a letter telling them they're in arrears when it's often the last thing .... but the screen shows a long list of minuses and you go lookng right back ..."
"That's what I did ..."
"And it's the last one, the most recent one, that's causing the problem ... we've actually had training sessions on this but it doesn't make any difference cos the screens are so difficult to read ... there's no arrears balance on statements so people can go for years without ever knowing with small amounts ... 70% of the cases are the first payment, so here we do it manually ... we pick it up first and notify the customer."

In other examples however, the problems which arise in the use of technology may not be so 'visible', because operatives find alternative ways of doing things:

Example from ethnographic report

Given that the Screens are in the case of the less common enquiries, not especially friendly, this engenders a certain reluctance to use them:
"The thing is .... we get an awful lot of queries at the cash desks, but most of us don't know what all the information on the [enquiry] screens means .... sometimes it's just easier to go to the leaflets .... when you can.",
and a degree of uncertainty and confusion when they have to be used. Experienced cashiers are adept at disguising their problems in interrogation to customers, but the less experienced are perhaps more likely to find themselves on the wrong end of customer irritation when their interrogation of the Screens is proving unproductive. There does seem a strong prima facie case for a more user- friendly Enquiry System.

This, from one of the first reports we ever did in this sector, reaches the moderate conclusion that user-friendliness is the issue. Later, when we compared what we knew

across several institutions and in more than one domain, we began to think that perhaps it was not. We began to think that the obsession with manuals, 'help' menus and so on was in many circumstances misplaced altogether. Of course, depth of experience and expertise will moderate interaction with technology, and one of the strengths of prolonged ethnography is that the difference between 'experts' and 'tyros', or between good and bad practice become evident. It is particularly instructive to see circumstances where even acknowledged 'experts' have difficulty:

Example from ethnographic report

The unpredictability of the screens with incorrect key presses has almost legendary status amonst operators, and I saw more than one example:
"eeee ... I've never seen that before .... I've pressed the wrong button ..."
[followed by a considerable period of time trying to return to the screen just inadvertently left]

This unease with the Screens on the software is supported from a variety of sources. Observations made by others in the office included:

"It's the seconds in between ... you have to make conversation and keep it going even when you make a mistake otherwise your customer loses confidence in you ..."

"It's the training, really ... course people in the branches are keen to do this kind of thing, to learn about it, cos it makes their life easier ... but they don't have the information in front of them ... they have to look for it, even the basic information screens ..."

"It was all going to be on the software... that was going to solve all our problems ... but it's just sitting there in many of the branches ..."

Comments from staff in other branches included for brief mention:
"You can get from one type of account to another ... if you can remember the right key sequence ..."

" ... but the screens struck you dumb ... you've developed your interview technique ... the things you've always said and the order and so on ... and all of a sudden you've got this THING in front of you ...."

"I did find the comparison screen useful ..."
"yes, but for TESSA you need to know after five years ..."
"That's in Cross Sell now ..."
"Is it ? What do you have to do to get it ?"
"It's ages since I've used it to be honest ..."
"and that's another thing, the Interest Rates weren't updated often enough ...."

Haphazard training appears to bear some responsibility for the lack of understanding of Enquiry screen procedures. As with so much of the routine work I have observed, variations in expertise are directly related to variations in experience. The following account is testimony to the need for a coherent approach to the user interface:

"I came across a screen I'd never seen before ... it's a screen where you're doing mortgages, it gives you everything .... I didn't even know it was there ..."

It should be stressed that all the above comments and extracts taken together suggest that it is the relationship between the flow of work and technology which is under investigation when we look at obstructions as we see them. In this respect, it is not the same thing as investigating the relationship between process and technology. For

instance, the problem of demeanour in customer situations is a product of both cumbersome interactions with the technology and the need to interact with a customer at the same time.

Organizational matters and concerns

Skill and Time.

This interest in skill is still uncovering interesting and unexpected aspects to the use of technology. Not least, it is arguably the case that some long- term, even generational, changes are being seen in the effectiveness of technological usage. That this is possibly the case has on occasion been remarked upon, as in the case of Davenport, who points out that changes in work activity as a result of I.T. innovation often take years to become manifest (Davenport, 1994). The impact of I.T. may not always be immediately apparent, but neither may the impact of skill deployment on the effectiveness of the system. This has a relevance to notions of adaptability in business, since all changes in business processes are intended to allow organizations to adapt to changes in the environement readily and flexibly.

The way in which changes unravel over time is subtle. It is not that the ethnographer is likely to recognise these changes purely because of the time spent in observation, but that the interest in skill raises the issue. Consider these two extracts:

A senior manager in an engineering firm.

"We've been particularly worried recently about the use of spreadsheets ... in our company everyone uses spreadsheets for analysis and forecasting ... but we're getting mistakes .... for instance, in one case two spreadsheets were merged and the people who did it obviously didn't understand the functions .... the really worrying thing is that the data got all the way to me before it was noticed ... I looked at the data and I knew it was wrong .... It's not as if I know anything about spreadsheets, but I do know the business ... and I've got all these figures and I knew they were wrong ... we think that there's a process where the people who set the spreadsheets up have left or retired and new appointees are just assuming it all works fine without checking. Its as though they have this faith in systems, perhaps because they haven't lived through all the problems there were when the new systems get put in place."

and anecdotally, at The University:

"Look, these marks have got to be wrong ..."

"How do you mean ... they're straight off the spreadsheet ..."

"Well, look, they did two projects, right? ... and their mark are whole numbers ... so the only decimal is going to be .5 ... how did they get .7 of a mark?"

"Oh shit, yeah ... what's gone wrong, then?"

Further, the relationship between skill and technology will not always be readily apparent, even to the trained observer, because long term changes in the environment can impingeon the relationship. Research in an Insurance Company showed that apparently stable relationships can deteriorate as a result of unanticipated changes outside the organization:

"The [expert] system I suppose has worked fine for the people who use it, although there are many that don't. You must have heard people talk about the problems there are with it, but for those that rely on it, it produces useful [insurance] quotes. However ... some of the older underwriters ... it is mainly the older ones .... have always said, 'these people may know about computers, but they don't know anything about insurance.' And just recently, the last five months or so, I'm beginning to think they're right, because what we've seen is a shift in the market. The market's gone 'soft' and the machines' throwing up quotes way above the going rate. It's losing us business because some of the people who've always used the machine are relying on the quotes it gives. An insurer would have a 'nose' for it, would know he's got to come down or he'll lose the business."

Sociological and organizational literature gives us some handle on why this might be the case, quite apart from the orthodox 'requirements' problematic. The problem raised by this kind of environmental change is redolent of the theoretical interests of the socio-technical systems literature.

Domestic Settings

Our observations concerning the appropriateness of various categories are thrown into sharp relief by a consideration of ethnographic research into domestic settings. Here, for the most part, the categories we evolved as suitable for organising research conclusions have little to do with those we used previously. This emphasises the point that such categories should only ever be illuminating. Domestic environments are interesting because they have become a site for rapidly expanding CSCW-influenced research (although other research into this area has actually been commonplace for a large part of the 20th century). The relevance of CSCW to these arguments is that as a research programme it emphasises *interactional affordances* as a major feature of the success or otherwise of new technologies. In this way, the design of new technology was held to be dependent not only on issues of *usability* but also on *usefulness*. It should be obvious from this that the basic philosophy behind CSCW translates straightforwardly into the domestic realm. The usefulness of new broadband technologies will equally depend on the real world, real time behaviours and interactions of people in the home (and elsewhere). Indeed, Frohlich et al call for effort to be directed to domestic contexts in what they describe as Computer Supported Social Interaction

Mateas et al (1996) provide a powerful example of the role ethnographic study can play. Their study of ten families revealed the complexities of space, time and communication in home life in a way which showed the inappropriate characteristics of the personal computer for the home. Whereas people cluster in what the author's call the "command and control" regions of the home – the kitchen and family room - the computer is typically in a work space, designed for use in a single space with clear demarcation between work and non work between being "booted up and working" or switched off.

Methodology.

The study we base our argument on was a broadly ethnographic study of a small number of families staying for limited periods in a 'Smart House'. The methods we adopted were a function of a range of constraints. These had to do with

1. The commercial auspices of the work, which meant that features such as length of stay were beyond our control, and

2. The nature of the house itself, which meant that the technologies it contained were necessarily part of our interest.

In our study, sophisticated digital video was used to record two separate images of family members' behaviour in each downstairs room of the house (4 in total) and two children's bedrooms (with children given the option of switching them off). The video cameras were in either 'wide angle' or 'zoom' mode. They were also, by default, switched on only when there was movement in a room. One of the obvious costs of such a video policy was the enormous amount of data that had to be analysed. Much of it, unsurpisingly, was done in 'fast forward' mode. This had one unexpected benefit, in that it revealed something of the 'rhythms' of family life.

3. Some of our terminology was used specifically because our clients for this study were familiar and comfortable with terms such as enablers and inhibitors.

4. Regular informal interviews were held with family members jointly and individually (including children) and especially at the beginning and end of their stays in the house. These interviews normally took place around the kitchen table. In addition, we 'shadowed' family members for fairly short periods of time, asked them to keep logs of their activities, and occasionally asked them to demonstrate what they had been doing.

Positioning work in the Literature.

Our concern was to undersatnd how research into domestic settings could be seen as a legitimate topic of enquiry for CSCW. That is, to contribute to the extension of CSCW interests into domains which are not to do with workplaces by examining some research into new technology and domestic environments conducted in a so-called 'Smart house'.[5]

One of the obvious ways in which we do this is to look at existing literature and identify the 'gaps'. These gaps may be either empirical or conceptual (or both) or, in turn, theoretical. In fact, research into technology and domestic environments can be traced back at least to the broadly Taylorist interests in the kitchen associated with Lilian Gilbreth, to feminists interested in the relationship between technology and domestic work (see for instance Berg, 1994; Bose et al., 1984; Cowan, 1983; Vanek, 1978 and Wajcman, 1991) and more recently to work by Hindus, 1999; O'Brien et al; and so on. (see Aldridge, Chapter 10, this book, for a complete overview) Having said that, there have been relatively few opportunities to examine family life as it occurs in an already existing 'smart house', as we shall see. The specific relevance of CSCW to the arguments offered below is that, regardless of its historical interests, it offers the notion of *interactional affordances* (Bowers and Martin, 1999; Harper et al, 2000) as a major feature of the success or otherwise of new technologies. In this way, if we may so characterise them, the design of new technology was held to be dependent not only on issues of *usability*- associated with laboratory based measures of human-computer interaction- but also on *usefulness*- and associated with the way new technology might be woven into people's real life and real time experiences at work. It should be obvious that such fundamental issues translate straightforwardly into the domestic realm. The usefulness of, for example, new broadband technologies will

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[5] Although work may well go on in the home, of course, viz. the phenomenon of 'tele-working'

equally depend on the real world, real time behaviours and interactions of people. Hindus (1999) also calls for more research into homes and technology on the grounds that they are economically too important to ignore and have the potential to improve everyday life for millions of users. Nevertheless, Hindus argues that research specific to workplace settings cannot easily be generalised to the home context. As she points out, homes are not typically designed to accommodate technology, they are (typically) not networked, nor do they have the benefit of professional planning, installation and maintenance of technology and infrastructure. Equally, 'consumers are not knowledge workers' – motivations, concerns, resources and decisions are different in the home. Thus, where workplace purchasing decisions are determined by concern with productivity, householders may well be interested in matters such as aesthetics, fashion and self-image. Further, 'families are not organisations' – they are not structured in the way that corporate organisations are structured, and decision-making and value-setting are quite different. These latter two points go some way towards explaining why it is, as Venkatesh (1996) has suggested, that, 'More segments have opened up in the 1990s, signifying greater impact and diffusion of computer technology in the daily life of the household' (p51) If so, the orthodox concerns of CSCW with work and interaction might be developed in such a way that we begin to understand the ways in which domestic and work environments are both similar and different.

One aspect of the literature that we identified was that there was in existence no clear typology of the 'Smart House'. Therefore, we developed one. The starting point was the distinction drawn by Gann et al (1999) between homes which simply contain smart appliances, and those which allow interactive computing in and beyond the home. Maintaining his focus on the functionality available to the user, we might identify five types of smart home:

1   Contains intelligent objects

Home contains single, stand-alone appliances and objects which function in an intelligent manner.

2   Contains intelligent, communicating objects

Home contains appliances and objects which function intelligently in their own right and which exchange information between one another to increase functionality.

3   Connected home

Home has internal and external networks, allowing interactive control of systems, and access to services and information, from within and beyond the home.

4   Learning home

Patterns of use are recorded and the accumulated data are used to anticipate users' needs. See for example, the Adaptive House (Mozer, 1998) which learns heating and lighting usage patterns.

5   Alert home

The activity of people and objects within the home are constantly registered, and this information is used to anticipate users' needs. See for example the Aware Home (Kidd, et al, 1999)[6]

The 'smart house' discussed below is in most respects an example of (3), the connected home. As we shall see, the research detailed below supports the idea of moving towards (4) at least.

Early concept formation- enablers and inhibitors.

Early examination of both the literature and our own data led us to come up with the following categories. We should stress here as well that these categories are not mutually exclusive, nor are they precisely defined.

1.   Individual v. collaborative activity
2.   Usefulness/fitness for purpose
3.   Connectivity/Information use
4.   Ease of Use/ usability
5.   Personalisation
6.   Overhead
7.   Bandwidth/Multimedia affordance
8.   Location
9.   Trust/reliability
10.   other concerns

Later, as we thought more carefully about the data, we subsumed these categories into some more general headings.

We thought of these as ordinary exigencies of family life.[7] Firstly, *control* seems central to family life in a number of senses but including at a minimum both control over the house itself and control as manifested in relations between family members. Secondly, it includes elements of what can be called *social connectivity,* which simply means the normal desire of family members to be in touch with each other and with a wider network. For convenience we can also distinguish between local and distance connectivity. What is meant by the former is the occasioned way in which family members group together or not in order to complete various activities. The latter refers to the way in which family members are also outward-looking, using technologies to relate to wider networks of friends and kin. Thirdly, *location* is of evident importance to family members. By this is meant the extent to which family life is conducted in quite specific locations. This was not the first study, for instance, to observe the degree to which the kitchen can be a locus for family-oriented activity.

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[6] We are indebted to Frances Aldridge for this typology.

[7] We should stress that these are analytic glosses and that much of what is reported on could be thought of in terms of any and all of these categories.

Below, these themes are examined by reference to the control systems; use technologies and other facilities mentioned above and then some general conclusions are drawn concerning the issues likely to prove germane in the future.

The Study.

The study took place at the behest of a large provider of mobile telephony services. They were and are committed to the project, which entailed the building of a functioning 'smart house' in which new domestic technologies could be evaluated. Because the house in question was and is a research environment, it has no permanent residents.[8] Attempts to evaluate the technology-in-use in the house, then, had to be done through the evaluation of short-term family residence. The house in question is characterised primarily by three elements. Firstly, there was a set of elaborate control mechanisms with which technology in the home can be managed by family members. For a mobile telephony company, the possibility of effective use of technology in a location-free way has huge potential and thus the use of control devices including mobile phones was a major feature of the evaluation we conducted. Indeed, seven distinct methods of control were, in principle, available to visitors, including for brief mention wall mounted control panels; Compaq TP/IP devices, and mobile phones. A second feature of the home was the use-technology, all of which was commercially available and included sophisticated entertainment media, kitchen equipment, baby monitoring, computer networks, security systems, and so on. A third feature was the provision of various facilities which could be used in conjunction with the available technology, such as for instance a health monitoring service and internet shopping.[9]

The methodology entailed an ethnographic orientation, obeying the injunction that, just as with working life, the point was to try and understand domestic life from the point of view of those living it. To this end, video recording was done continuously in all 'family rooms' in the house; family members were 'shadowed' through the house on an occasional basis, and were interviewed at the start and finish of each period of residence. At the outset it should be emphasised that only a small number of families (3) have had an opportunity to be resident in the house, and for limited periods of time (the longest hitherto being two weeks). The families are similar in many respects, in that all have 'professional' fathers and part-time working mothers and in all of them at least one parent could be regarded as highly computer literate. All three families, for instance, had at least some familiarity already with the Internet: with chatrooms; and with digital and video imagery. All were familiar with mobile phone technology. Individual members of the families had expertise with MP3 and Midi; with Netmeetings; with Search engines; with digital video and photography. Two of the three fathers had sophisticated understandings of the use of electronic resources for music production. Each family was structurally broadly similar, in each case having three young children. The oldest child in any of the families was 12. No teenagers, elderly people, or extended kin formed part of the study. In two of the families the parents were in their 40s, and in one, their 30s.

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[8] Not least because it periodically undergoes radical change as new technologies and systems are installed, and old ones removed.

The practicalities of family life

Control

All visitors to the house were carefully reminded that its facilities were not to be seen as final versions but as interim solutions, the purposes of which were to elicit reaction. It was extremely interesting, therefore, to see the dimensions which governed responses. At the outset, one should stress that the ability to control a range of functions remotely, including heating and lighting, security and so on was very positively received. The ability to control some functions was clearly a great pleasure in certain circumstances: *'I always read in bed, and it's nice to just reach over and switch the lights off. Same in the morning- I have trouble getting up- it's lovely to be able to open the curtains from bed.'* This sentiment was repeated by more than one person, and applied equally well to not having to get up from the sofa. Equally interesting, however, were negative sentiments. These centred on problems associated with overhead; robustness and reliability, and (ironically) lack of control. Overhead here is not to be equated with cognitive load. People often reported no difficulty using control systems, but nevertheless expressed intense irritation. 'Overhead' here refers to whether the ecology of the setting is such that people can complete tasks in a simple, elegant way or not. It seems that what we observe in work settings (see Harper et al, 2000) is paralleled by domestic life, down to the fact that unnecessary seconds seem to matter to people in domestic settings as much as at work. A simple exemplar of this issue was the lighting in the house. The existence of an overhead in doing simple things like switching lights on and off was a constant irritant. Comments such as the following were typical: *'Things must be simpler to do than in a normal house … I don't want to work through a menu just to turn off the lights. Again, I hope this will be improved with voice control',* and, *'It should never take longer than it did before. Keep it Simple'.* Similarly, *'we need manual over-rides. We do not want to fiddle with remote control for the washing machine when we're standing in front of washing machine …'* and, *'The controls just aren't sophisticated enough to run the washing machine, and do you really want to spend five minutes trying to get it to do what you want?'*

In the same way, robustness and reliability turned out to be significant. Examples abounded in the study of family members experiencing, for them, strange and bizarre behaviours by the control devices. As one put it: *'The plasma screen was completely unreliable- the only way I could get it to switch on was by re-booting the control device. The DVD facility was the same – the only language we could get the DVD to play in was Danish!. If I went through the wall panel and selected DVD, then the device would work with the Plasma screen. That's really weird …'.* For one family, system unreliability culminated in a minor disaster: *'The cupboard doors between the bathroom and the master bedroom were stuck open. We couldn't get into the bathroom at all. And the control device was saying the doors were closed!'* This issue of reliability was nowhere more evident than with the locking and security features. Again, it should be stressed that the general principle of security systems of this kind was very warmly received, as in, *'I really liked it. I felt very secure. I think its very good to be able to check up that you've locked all the doors and windows from afar …',* but unreliability was a critical factor: *'I felt that there was a real risk that people would get locked out. In fact, while I was there the kids got locked out in the garden because there are no door handles on the outside of the patio doors in the kitchen.'*

Similarly, *'We went out once and I locked up, and I decided I just needed a wee before … and I went back into the house but I couldn't get back into the bathroom …'*

Perhaps most interesting, however, was the paradoxical sense in which elaborate control mechanisms could generate a sense of lack of control. By this I mean that control systems were resented if they did not allow users to engage in and complete the activities they wished to undertake, and where designers had simply presumed they could predict what users wished to do. Thus, some users (though by no means all) expressed negative sentiments about the bathroom: *'The bath, though, it didn't fill up off the control panel and it's a daft idea anyway. Actually, the bath in the en-suite bathroom doesn't empty properly either. I can't imagine why anyone would want to run a bath remotely.'* When asked whether there might be specific benefits for, for instance, the disabled, one father agreed, but said, *'I'm still not sold on it, even if it was tailored to my specific desires. I like bubble bath and you can't put that in afterwards … there's always contingencies, and you can't do it. The top-up button doesn't work well enough. I wasn't getting the control I wanted.'* The same adult went on: *'Simple tasks just look a lot more complicated. I left a room, switched a light off, went out and then remembered that I'd left something in there and was fumbling around in the dark'*, and, *'There's not an ordinary tap in the house and it drives you mad. You can't control the water volume and it's inconsistent. I really disliked the lack of control.'* Paradoxically, it seems, the elaboration of control can result in a sense of lack of control.[10] A potentially important element of this derives from the fact that family members do not naturally check to see if others might also be interacting with the control systems: *'We've already discovered we find ourselves all trying to control the same thing at the same time. They (the control systems) don't tell you that someone else is trying to do the same thing. Overall, its got to be quick and simple.'* This lack of feedback may be in part why all the families reported odd 'mysteries', where things did not happen in quite the way anticipated.

Social Connectivity

Local Connectivity

Previous research into domestic life has tended to emphasise the importance of location, and there is no need to demur here for there can be no question that family life is currently location-oriented. That is, the use of certain technologies is normally associated with specific activities in specific places. The video data confirms other research in making it clear, for instance, how important a place the kitchen can be for family life.[11] Nevertheless, video observation also provides us with a rare insight into

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[10] This sense of lack of control was evident in ergonomic matters as well, reflecting the need for attention to particular categories of user: *'Little kids can't reach the control panels, and they need lights to do things like sit on the potty. The cleaner, Mary, had to borrow specs to read what the control panels said.'* (general laughter from a rather middle-aged group of people)

[11] One feature of the house as initially designed was the way in which assumptions were made about appropriate technology in the kitchen. Thus, where technologically advanced fridges, washing machines and dishwashers were all present, the absence of other technologies was keenly felt: *'Its typical, really … there's no decent TV here … this kitchen*

the *rhythms* of family life. One feature of this, seldom remarked upon, is the way in which families are seldom 'collective entities' for long periods of time. They come together on certain kinds of occasion e.g. when eating, but soon separate to engage in more individual purposes. Nevertheless, they remain families. That is, even when engaged in isolated pursuits, family members regularly 'check out' the activities of others. The video data shows that husbands and wives, when both home, though they may be engaged in utterly different activities in different parts of the house, will move back and forward for short periods. This is even more marked with the behaviour of children. Children are often a locus for the most pertinent of the 'privacy' versus 'connectivity' issues that are central to family life. Younger children, as we all know, will 'pester' older children to play. They sometimes appear to be joined by invisible string to their mothers (video data showed how frequently children will appear in the kitchen for brief periods when mother is working there. Occasionally, they remain near and engage in play in the kitchen.)[12] This local social connectivity has a number of repercussions. A significant finding of the video data was the constancy of 'monitoring behaviour' in the family. Parents, it seems, habitually check up on the whereabouts of their children and each other. Moreover, it is common for the children to engage in the same behaviour towards each other and towards their parents. Part of this will be normal parental anxiety, as expressed by one mother when she said, *'I need to keep an eye on Peter, who has a bit of a tendency to run off'*. Peter is the youngest child in this family. This kind of behaviour goes a long way towards explaining the popularity of 'surveillance' technologies like the baby monitoring equipment in the house.

Questions which arise concerning what technological affordances are appropriate to what locations, or conversely whether developments in computing might make domestic technology location-free will be answered in part through understanding the nature of these rhythms. One can usefully describe this issue as being on a continuum from 'personalisation' to 'integration'. It is a truism that not everyone has the same priorities, and typically with the use of, for instance, PCs we are prone to 'individualising' or 'personalising' the technology. Indeed, there was evidence of the importance of such things for young people through one 12 year old's desire to spend time on-line in order to download various pieces of software (icons; dialling tones, etc) that he could use to personalise his mobile phone. These issues are not only important to the young. We see similar demands, for instance, with kitchen technology. At the same time, personalisation of technology is a risk, in that the more personal the interface the less usable it is by others. This is a particular risk in the context of family life, and was evidenced in data around the use of, for instance, the CD system. The other pole, then, is that of *integration*, whereby all functionalities can be used by all family members everywhere.

Integrated technologies proved very popular in certain respects. Most adults found uses for controlling devices at one location in the house from another: "*Switching*

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was designed by young designers for whom looks were more important than function and who were not familiar with family life with young children.'

music on from anywhere in the house is great" This emphatically did not, however, apply to devices where physical presence would at some point be required: *'I have to go to the dishwasher to load it, so I don't need remote if I'm in the house. I could see a use for coffee machine, so coffee was ready when you get home. Can't see why I would want to do the washing remotely'* Surprisingly, there was general scepticism about remote access, which had to do mainly with fitness for purpose: *'Why would I want to run the washing machine from outside? I think you'd have to be very fussy to care …I suppose there are some people who don't like leaving clothes in the washing machine because they get musty …'* Similar observations were made with regard to cookery and related functions: *'The longest thing we buy to cook is stuff like frozen pies. I suppose I might want to turn the oven on …. I might … but it'd be pointless really, because the pies would be defrosted anyway, wouldn't they?'*

In any event, as suggested, the argument is for a more nuanced view of location, and one which pays account of whether activities are individual or cooperative, and the occasions upon which this may be the case. Distinguishing between the two is no trivial matter. Thus and for brief mention, adult information-seeking behaviour in the 'smart house' tended to be something that parents did alone and at night. Two out of three families broadly followed this pattern, especially where the 'surfing' activity in question was hobby-related. The main exception to this kind of behaviour occurred with highly specific and short-term information seeking. One family, for instance, showed us how they had decided to buy Chinese food one evening, but being unfamiliar with the area had used a Mapping service to identify exactly where it was.

Entertainment, and especially television use in the 'Smart house', in contrast, seemed to have a more complex patterning. On the one hand, individuals such as older children often reported that they watched TV on their computers, to 'get away' from their siblings. Equally, one room in particular- the study- was clearly used as a place to get away from the kids by most of the adults in our sample. One mother spoke of her television watching behaviour on her own in the bedroom: *'I pretty much always watch TV just before I go to sleep…'* This suggests that some technology can be personalised by location, particularly where functionality need be allocated for people working from home. (Video data shows that the one father who did any work at home did so in the study). It is also entirely in keeping with what we know about the spread of second- and third- TVs and videos through the home. Interestingly, when children watched TV on their PCs they invariably did so on their own. Having said this, I do not want to give the impression that TV watching has become an entirely individual phenomenon. Films, in particular, are sometimes an occasion for all the family to sit together and watch and it is normal to have one TV set which is co-opted for family use. Thus: *'We don't watch a lot of TV together, but we have a wide-screen TV in the back room, with Sound-Surround. I like to watch Coronation Street in there, but the boys don't actually watch that much TV because they prefer Playstation. But sometimes, we'll all watch a film- we sit and watch all the way through it.'* In another family these facilities also proved very popular with the children. Hence, *'The kids liked the fact that you could watch TV and use the computer on the same screen- they could switch from one to the other. In fact, though, the kids watched a lot of TV in the adult bedroom on the Home Entertainment System … because of the screen quality. All three of them would be in there playing with the bed settings and watching films … We did find we were rather less likely to watch as a family'* One father had a rather different view: *'I can't see us using these Interactive TV facilities a lot. We have one main TV at home, and there's already too much dispute between the kids.'* The lesson, one might argue, to be drawn from this is that rather than location itself, the individual or collective purposes of family members is the critical issue will be found elsewhere as well. One area where this proved to be of particular interest in the study was that of

information use and educational activity on the part of young children. Parental involvement in educational activities with small children was striking, largely because the children themselves demanded it.[13] That is, educational activity for young children is typically cooperative. In practice, it often requires parental or sibling input: *'Computerised tasks seem to take a long time, and we tended to find we were occupied.'*

Research has also suggested online education is becoming an increasingly important reason for logging on. If so, one can argue we need to know a great deal more about what the educational activity in question is. If variation is to be found with something as commonplace as TV watching, it is likely it *with all sorts of things. How long did it take you and Sam to do those invitations?'- 'it took over an hour. Steve had to start the dinner. That was because it was the first time we'd used it, though. We did enjoy it, Sam especially.'* This is in keeping with other research in the educational arena which also stresses the importance of timely adult intervention with interactive media (Hemmings et al, 2001).

This was acknowledged by the children as well: *'Lee helped me to find wallpapers and the Buffy screen- its hard to find ideas on your own. My mum had to show me Photofun, and you could move around in it … We printed things off the [live]board. It was good, I like the board.'*

Thus, understanding the problem of locating technological functionality is in no small part a question of understanding who will use it, and when. Educational activity for young children, we suggest, typically requires others to be involved and has consequences for any personalisation by location. Video evidence showed how young children will frequently play around the kitchen table while the adult works at some domestic task. On the other hand, when specifically educational work needed to be done, adult and child children have to leave the kitchen in order to do so. It would appear that here is one obvious reason for computer functionality in the kitchen.

Given that technologies are frequently designed with a single user in mind, or otherwise with groups of user in mind, this evidence would seem significant. It is, of course, important that a given design actually reflects the real-life group/individual dynamic it is designed for, and our evidence suggests that, in the domestic environment, a great deal of care is needed to distinguish one from the other, and more pertinently, on what occasions we see a preference for one or the other.

Older children are more likely to utilise PC functions consistently, but again their use consistently orients to their social needs. In the case of one 12 year old, the main uses for the PC, leaving aside games, had to do with visiting various Websites. He spent some time explaining how his favourite while at the house had been Boltblue.Com. His comment was as follows: *'BOLTBLUE- Its great cos you can contact your friends for nothing- e-mail or SMS. My stepsister showed me Boltblue, and I use it after I've finished my homework. They have thousands of icons, I've got one on my phone- they've got loads of categories like sport, music, cartoons. You're only allowed to download two a day- I've used up all my limit for the month. It has ring tones as well, but I can't download them because my phone doesn't have Composer. It's a 5110.'*

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[13] Conversely, parents often seemed simply to presume that the computer activities of older children were educational, without any direct monitoring.

The same boy also commented very positively about the master bedroom screen, 'We spent a lot of time watching movies on the big screen. It was cool. It was a bit like being in the cinema.' Even so, we should not give the impression that this closeness was continuous, for it was not. It was, in fact, thoroughly episodic. Thus, this 12 year old also said, *'I sometimes watched TV in the family room to get away from my sisters. I couldn't use the remote to switch over to Sky so I had to get up to switch over (and I like to flick). I escape here … watch TV on my own. I did play with the girls though. I drew pictures with Sammy and Em. Sammy and I would print out notes for each other and leave them on our beds.'*

Touchingly, and revealingly, he also commented, 'yeah, I have used the computer a lot while I've been here. But I don't so much at home. The truth is I get a bit lonely and I miss my mates here. Like, I always do my homework with them at home …' Although relatively young, this boy's comments resonate with sociological research about teenagers and 'bedroom culture'. (see for example McRobbie, 1991) and one might venture to suggest that the applicability of technological functionality in this context should be understood in and through the peculiar and somewhat marginal status of the teenager.

Distance Connectivity

Observations led to the view that issues of distance connectivity are important in two ways. Firstly, the direction of monitoring and information flow is important, and secondly issues such as immediacy and image quality seem less important than simple sociality and the historical sense wider networks provide. To begin with the issue of direction, there is a world of difference between being able to monitor the world outside the front door in a variety of ways and the world outside the front door monitoring you. This became evident when the use of the health and medical monitoring facilities was observed. All three families reported much the same thing regarding the exercise and health facilities, summed up in the following comment: *'We started off using it but it dwindled away. For a start, we're not as fit as we thought we were. I'm not a hypochondriac so I didn't really need the help. We didn't get any feedback from them in any case- perhaps that should be reassuring- the nurse was very thorough when she came round- if you actually had some condition it would be very good. The nurse suggested we did it every day, but we didn't … just occasionally. It wasn't really for us. To be honest, I just didn't like it … I don't like being constantly monitored …'*As another woman said, *'it's good. I like the idea of checking blood pressure, cholesterol etc but only for my own consumption - not outsiders.'*

In contrast, information seeking behaviour around health was not unusual: *'I did ring them up one time- it's a 24 hour advice line. [my daughter] had a rash and it spread over the course of a night. She was whingeing and I was debating whether to take her to a doctor and they told us we should. It could be to do with the water …'* The same kind of general enthusiasm for health information is to be found in the following comment: *'I had a contraceptive injection and I browsed the net and had a look-*

there were thousands of women who had the same side effects as me. It was brilliant to be reassured. I did a search on the name of the drug, and found it posted on a bulletin board. My doctor never said anything about side effects like emotional and hormone problems. I could talk to other women who felt the same way as me in a chat room' In sum, where family members are unenthusiastic about outside monitoring, they are positive about the affordances of technology when the direction of the monitoring is outward.

A very striking feature of all our families was their enthusiasm for any technology which allows them to be connected more widely, especially to other family members, and to special interest groups. Hence: *'I talk to a lot of people about bike stuff. I sort of know these people. I like it. I just stumbled across 'Bikers Café'- I just found it. I did search for bike stuff generally. I like the people in the Café, it's a nice social scene. I've been using it for about two years. Its been very frustrating not to be able to do it here. Lee uses chat rooms as well, with other kids.'* (Any value in mobile access to chat rooms?) *'Probably not … I mean, there's only so much time … teenagers might …'* Perhaps the most striking feature of the research was the universally positive reaction to the affordances of digital photography. Video data showed the extensive use to which families put the digital camera; the display screen, and the printer. Even if we factor in their natural desire to record as an 'occasion' their visit to the 'smart house', their delight in the affordances of digital images was apparent across all families, and more or less regardless of age. Thus, the 12 year old boy in particular was a great user of this camera: *'I haven't got a camera. The digital camera was easy, though I've only just found out you can print out all your photos at once. I didn't know how to save them to the computer, so I was sending the image straight from the camera to the printer.'* His mother commented: *'He loved the digital camera. I think its fantastic as well. Have you seen all the photos he's printed out? [There is a large pile of printed images on the kitchen table] I think its great. My sister has one, she's already sent us a CD full of photos.'* The mother in another family, a self-confessed technological illiterate, was entirely positive about this. As she said, *'I like taking photos, and I always have them developed in a 7 by 5 format. That's very expensive, and a waste of money if your photos are rubbish. The digital camera was just fantastic. It costs you more or less nothing to take photos, you can chuck away the rubbish ones without developing them, you can print them out cheap, and if you want you can buy high quality paper and print them out on that. That's what we did. We also found out there are firms that will print them for you (on the Net). We're going to buy one.'* She made a further point: *'I already use e-mail, but the reason is because my sister's profoundly deaf. So she can't talk on the phone. This would be great for sharing- I could send her pictures all the time.'*

There has been some research on the role of photographs in family life, research which stresses the inherently social nature of the image (see Frohlich et al, 2001). Put simply, looking at pictures is something that is typically done as an ensemble. Families will review recent experiences; will share them with other kin or with friends; and will use images as a focus for recall and talk about these experiences. A significant element in the popularity of this form, then, is the way that digital images can be conveniently meshed with ordinary family concerns to record their history; and relive recent events and significant occasions of family life. The popularity of Netmeetings can very much be seen in these terms: *'Net meeting would be a popular option with us. With the speed of the access here, and the* <u>*bandwidth*</u>*, that would be*

fantastic. Actually, the image quality isn't that important to us. I can tell enough. We can still see [our niece] growing up. Through Net meetings, our friendship networks have actually grown, like my sister now knows some of my other friends and will talk to them even when we're not logged on. With MSN you can send files more or less immediately, so you can look at photos and stuff like that.'

Interestingly, these web conferences with wider family in Canada and other parts of England did not seem to depend on immediate interactional affordances, and the above comment may help explain why. Family interactions of this kind may well be more about getting historical markers for family relationships —the niece's size since they last saw her and such like— rather than the ability of digital imagery to convey gestural information. If so, this has some profound implications in terms of the difference between home and work settings, particularly in the context of video conferencing. Where for the most part video conferencing has hitherto been something of a niche market, largely predicated on social scientific observations concerning gesture, gaze etc., it rather seems here as if these features are less important because there is seldom any immediate task at hand. There would appear to be very considerable mileage in continuing to explore this theme, especially as Frohlich et al's research into photography in the home has shown how important this process of family maintenance seems to be. One avenue of exploration would be to compare teenagers' use of such devices with family-oriented use. A second has to do with display technology in the home, since two of the three families showed clear willingness to play with digital display, and particularly to identify how such display technology would be used on occasions such as 'family get-togethers', especially when some family members are missing.

In many ways, these tentative results echo Frohlich et al's previously mentioned work. This describes the different types of conversation that take place on the telephone, notably single topic, purposeful calls and multi-topic calls which are more concerned with maintaining personal relationships rather than with the achieving of specified objectives. Their work points towards guidelines for the development of technologies to support the types of conversation that happen. In much the same way, if we are to develop domestic technologies to support distance connectivity, it must be through an understanding of what people actually do in these situations.

Conclusion

Our data led us to produce an argument for the inclusion of domestic life and the new technology that might be associated with it into the CSCW research programme. Whilst entirely in agreement with Hindus (1996) in respect of the fact that domestic life is substantially different from working life, there is one respect in which it is analytically the same, and that is the way in which new technology in the home may have to be understood in terms of its interactional affordances. It is for this reason that the notions of control and social connectivity here have been emphasised. In our view,

a prior emphasis on location, while entirely valid, does not wholly come to terms with the rhythms of family life as described above. Issues of control, as suggested above, cannot be reduced to cognitive load. They include not only the individual's sense of being able to use the technology in simple and elegant ways, but also in family life the sense of control that comes from knowing what others are doing or have done with the same technology. It appears that significant feedback is necessary if that sense is to be maintained. Equally, families are not in a behavioural sense units. Neither are they collections of individuals who happen to live in the same location. They can be understood as individuals who orient to their family membership at specific times and in specific ways. Our data shows how family members both avoid other family members and seek their company, can be engaged in activities which entail them being alone, and otherwise act collaboratively. The point is, of course, to distinguish which is which, and when. That is, a sophisticated view of social connectivity will be necessary.

Social connectivity comes in two distinct forms which we called local connectivity and distance connectivity. They refer to the quite ordinary respects in which family members firstly orient to one other, and secondly orient to others outside the family home. Both, I think, are interesting and important. The first is important because it pertains to, along with issues of control, the problem of personalisation and point solutions. Local connectivity, one might argue, is a critical issue for the desirability of personal, point solutions in the household. In the near future, however, other forms of personalisation will become more salient. The likely reason for this is the spread of networked devices through the home, just as the network has become the default in workplaces. The prospect of most computer-related devices in the home operating from one central server opens up a whole range of possibilities, of which the *personalisation of the interface* is one. If we take as an example the kitchen again, we can see that different screen sizes may be appropriate in different locations. (Information screens near the fridge and/or cooker will not need to be large- around the kitchen table, they may well be bigger.) Given the problems of control, which were referred to above in terms of overhead, reliability and so on, the use of information resources will depend on how quickly and easily information can be input, used and retrieved at various locations, which will in turn depend on dedicated menu structures/local interfaces. To give an obvious example, the use of lists in kitchens, and a variety of technologies suggested for use in association with the list (e.g. bar coding; automatic food ordering; prompts for suitable meals, and so on) will depend in part on the elegance and immediacy of the design solution in question.

In some respects, the kind of smart house referred to above as the 'learning home' and 'alert home' will deal with these issues. Thus, the kind of personalisation the learning home will deliver will deal with the issues of control observed in the bathroom, and which are captured by these sentiments: *'why can't you … why can't you specify a temperature for each person, and an amount to fill it up. That would be great, wouldn't it? I could just input [the name of son] and he'd get a lukewarm bath, which is what he likes. Me, I like it scalding.'*

Such an arrangement would obviate almost all complaints about lack of control in the bathroom, and indeed elsewhere. We might call this *personalisation by profile*. Nevertheless, this kind of personalisation is also fraught with difficulty. We have seen how problems arise with the control of security, entertainment and other systems in the home. Some of the reported difficulties have to do with simultaneous commands, lack of feedback, and the absence of a clear structure of priorities. This became evident in, for instance, use of the CD system. Such systems require more than command structures which allow different individuals access to different menus in

such a way that their musical preferences are available; their preferred volume settings, and so on. They also need a sensitivity to the history of control, covering such matters as who last used the device, when, and what for. It raises, amongst other things, the vexed issue of entitlement- who has a right to override other commands, and who has not. It was, in fact, clear in this context that the house's music system, while broadly popular, underestimated the passion of the music 'buff' and their desire to be in complete control of what they listen to.

A third kind of personalisation issue is that of *personalisation by activity*. Thus, when kitchen equipment and the possibility of electronic support for shopping, cooking, etc., was discussed, few family members showed any interest. When they did, it was surprising how little they wanted. There was some support for keeping electronic lists using stylus entry on a wall-screen, along with prompts (presumably from the fridge and/or the cupboards) indicating that certain goods were running short. One mother, when asked if recipes on a screen would be useful, said, *'not really … mind you, if they were connected up to the oven and the microwave, so they automatically went through the right heating sequences and the like … that'd be good …'* What this indicates is that we need a much better sense of what the activities in question, such as shopping or cooking, actually are before we can decide on the usefulness of technologies to support them.

Lastly, and most profoundly, the issue of personalisation depends on the degree of local social connectivity observed, and this affects *personalisation by location* above all. The expected move away from the PC in the home will have to be accompanied by some careful consideration concerning both which kinds of both device and application will turn out to be appropriate in which location. It is clear from the study undertaken that we need to know a great deal more about the behaviour of young people vis-a-vis, for instance, educational experiences in the home. As suggested, the PC is inappropriate as a bedroom based resource for young people to engage in educational work for the simple reason that educational work turns out to be typically collaborative. Given that parents are often busy with other activities when demands are made of their time, consideration must be given to the appropriate kinds of control surface for the kitchen. It is also relevant to patterns of entertainment use, for the location and type of entertainment systems will depend very much on the nature of family life. Several parents expressed their anxiety about the way in which their children were more isolated/ spent more time watching TV etc. Increased personalisation of technology for children may well exacerbate that situation, at least among certain age groups. Moreover, and something that needs appreciably more research, is how personalised devices can be provided in such a way that more casual visitors to the home (guests; wider family members) can also use them.

In this study at least, the issue of distance connectivity turned out to be the most surprising and most positive aspect of family life in the 'Smart house'. We were surprised by the sheer vibrancy of extended family connection, and the desire to expand it wherever possible. It is clear from these results and from elsewhere that in many respects the extended family is alive and well. That is, regular contact with a wider and dispersed set of family members should be regarded as a typical feature of modern family life, arguably more so with the advent of widespread communications technology such as e-mail. In a sense, of course, 'twas ever thus given that the letter and telephone have existed for a long time now. Even so, mobile telephony and text

messaging; digital images and video, netmeetings and so on all afford regular contact with others, not only on an individual basis, but also collectively.[14] There is some evidence from the study that there is already take-up of these possibilities.[15] We might note of a number of features of this distance connectivity, all of which are potentially important for the take-up of new technology in the home. Firstly, where monitoring or information use is the issue, there appears to be a very significant difference between outward looking and inward looking facilities.[16] The families showed themselves to be very uncomfortable with any facilities which they felt involved the monitoring of their behaviour, even when it was for the best of reasons, as with health monitoring. This has to do with the obvious but often forgotten fact that family life is private life. A second feature was to do with the fact that, for our families at least, issues of image quality and bandwidth did not appear to be particularly important. This, we suggest, is because in the domestic context the immediate interactions involving other family members or wider social networks are less important than the maintenance work involved in these communications. Digital imagery and video interaction in this context was above all a means to maintain family and social solidarity and history. It is perhaps for this reason that reaction to this kind of affordance was so positive. In turn, this presented the most surprising result of the enquiry. CSCW practitioners are familiar with the general failure of video conferencing to provide more than a niche market in organizational life. Tentatively, and bearing in mind the small nature of the sample, I suggest here that in the medium term it may well turn out to be much more central to domestic life. Indeed, one family in the sample was adamant that they had made many new friends, and that their networks had spread and become more dense as a result of their on-line activities. Of course, some of the issues entailed will turn out to be the same, certainly in terms of document or image sharing. Nevertheless, the increasing popularity of new forms of netmeeting, for instance, is an eminently researchable arena.

In summary, it is clear that patterns of connectivity will be difficult to predict on the basis of this small sample. Having said that we can perhaps think in terms of two axes

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[14] Any thoughts we might have about the way in which technology in the home might relate to younger people would benefit from more nuanced studies of teenage behaviour, because there was no opportunity to observe any such animal in this study. Having said that, it is apparent that connectivity in general, evidenced by the widespread take-up of mobile telephone and SMS messaging (see for instance Grinter, 2001) suggests that teenagers may well be a significant audience for some technological developments.

[15] A significant feature of this, however, is that such kinship connection does not only take place at a distance. Again, a common way of expressing family values is through the ordinary rituals of life, including births, marriages, etc. equally, Christmas and other festive occasions are also treated as occasions for family 'get togethers'. The existence of powerful family networks of this kind is another source of possible bias within our sample, since issues of personalisation and stability, ease of use and control ought to be investigated not only in the context of the immediate family experience but also in the context of links with family and friendship networks. For obvious example, personalised technologies have an obvious conflict with visitor use. The regular occurrence of family occasions where wider kin are habitually pressed into service presupposes that user-friendliness may have to take this into account.

[16] We have no space to discuss the intermediate forms of connectivity involved in *Integrated security and communications technologies*. These include applications which link remote householders to those wanting to access a home such as trades people and delivery persons; alarm monitoring, and so on.

for a matrix model which might inform attention to domestic life studies in the future. On one axis is the closeness/distance continuum, and on the other are the various social factors which might influence the need for connectivity, including for instance the needs of families with young children; with teenagers and their work of 'doing independence'; with 'empty nesters' and their desire to extend their social life, and with the so-called 'silver surfers' and the construction and maintenance of family history. In any event, the scope for future research of this kind is enormous.

Clients

I. **Describing ethnography to clients.** Commercial, or for that matter 'real world' organizations of any kind, will have a set of expectations as to what it is the ethnographer does and what the potential value of ethnographic analysis for them might be, especially in those circumstances where the organization which is the site of investigation is also paying for the investigation. In some situations, individuals may have a surpisingly sophisticated understanding of the analytic auspices of ethnography. In others they may have inflated, not to say absurd, ideas about what ethnography can provide:

Some examples of comments that have been made:

"Actually for the most part the things you're telling me are things I already know, but that doesn't matter ... you're giving me ammunition, and I really need ammunition. " A Quality Manager

"We find your interest in teamwork potentially very powerful. This organization would be extremely interested in anything you can do to help us design our teams ..." A Bank Manager

I'm still not sure exactly what it is you do, but the more I hear about it the more I'm convinced it'll be extremely powerful ....extremely powerful ..." A System Engineer

Unsurprisingly, although comments like the latter two are in a sense flattering, they are also examples of over- inflated expectation. Managing expectation is an important element of negotiating with clients, and in our view an honest assessment of what is possible should always be made.

Our perspective is always to attempt to be modest about the potential for ethnographic analysis. That is, to manage expectations downwards wherever possible. Nevertheless, there are some points worth making about what ethnography can contribute, and we tend to argue that ethnography has two major strengths:

1. Sanity or reality testing.

One of the principle purposes of ethnographic analysis, in our view, lies in its complementarity to formal modelling processes. That is, there are as yet no examples of commercial systems which have been designed around ethnographic data alone, and we doubt there ever will be. We suspect that formal modelling will always and inevitably be a part of the systems design process. Ethnography produces data which is qualitatively different and analyses aspects of work and behaviour that formal modelling cannot encompass.

Example from Ethnographic report

The rationale for the study was in the first instance, to conduct a 'sanity check' on aspects of the business process model. The check in no sense concerns issues that surround internal consistency or completeness of the model. It is intended only to provide a basis for assessing the correspondence between the model and 'real world' activity. The study reported here deals only with some of the processes specified at the 'bottom level' of the model. Although every attempt has been made to be thorough, no doubt some transactions are relatively unusual and have not been observed. Equally, Building Society work involves a flow of transactions across Departments, often via the computer interface. Therefore, the observational work undertaken can stand as a critique of the 'model' only in a very restricted sense, primarily because the observations encompass only a small part of the totality of Building Society work.

2. Organizational knowledge.

All organizations experience a gap between managerial pictures of situations and those of individuals in more specific organizational positions.

This example illustrates in outline how there may be a very significant gap between managerial assumptions and the reality, for instance, of workplace culture.

"The whole objective has been to move towards a selling culture. Historically, the business has been in the business of making money from customer accounts .... now, we know we have to sell ... you can't differentiate by product any more, you have to differentiate by service ... so all our efforts have gone into developing a selling culture ..."

"We were quite interested in the notion of a selling culture ... you know, you spent some time explaining it to us in our last meeting ... errr ... as you know, there have been five of us in total, observing in two different branches ... well, I have to say, and we're all agreed on this, we didn't see any evidence at all of the selling culture you describe to us." [Goes on to cite various instances where selling could have taken place and did not.]

Long pause ...

"That's ..... interesting. If that's true, we really need to know why ..."

[Ethnographer goes on to remark on the difference between the way in which workers will take up managerial initiatives enthusiastically in meetings where managers are present (and which he attended) but tend to revert to what they've always done when they are not.]

Writing up ethnography- report writing and organizational interests.

How fieldwork is to be 'written up', of course, depends on a number of factors, not least who is likely to read it. Experienced ethnographers, it has to be said, are used to the way in which the reports they provide often go unread, whereas the way in which they are expected to be 'on hand' to explain stuff contained in reports over and over again never ceases to amaze. There are good reasons for this, as we have hinted at above, and 'getting the point across' relies on structuring reports in a way that allows different parties to get what they want from it. The typical structure of a report would be something like this:

1. Purpose Statement.

Example from report

The primary purposes of the enquiry can be summarised as follows:

a. To describe details of the work activities of cashiers in specific locations.

b. To analyse the significance of features of that work.

c. To highlight 'obstructions' and 'routine troubles' in the flow of work that stem from current practice in the use of resources.

d. To suggest areas where system intervention may add functionality

e. To suggest areas where the introduction of new systems may prove problematic without attention to certain issues.

f. To suggest areas where the study is incomplete and what benefits might accrue from further work.

2. An Executive Summary.

Whether we as ethnographers like it or not, the fact is that very few people in the client organization may ever read our report. At the same time, quite a number will need to know whether or not they should read it, and what its main conclusions are.

Example from report.

Executive Summary

The main report is divided, for convenience, into two main sections dealing in turn with cashier work and with mortgage processing. At the same time, as the research progressed, it became clear that many of the issues that arose were germane to both kinds of work and are discussed as such in the concluding section.

1. The work activities of cashiers in specific locations.
The focus for description was both interactions with computing equipment that occur during the course of the work, and work that is done without recourse to electronic data. Recognising the way in which expertise and skill is distributed and deployed in the successful accomplishment of the purposes 'in hand' has significance in a number of contexts. In particular the importance of demeanour work as a means of maintaining customer confidence is discussed in detail. In using technology, the cashier must 'weave' interaction with technology into the flow of interaction with customers and in such situations the technology ideally should be 'invisible'. The concept of 'customer care' has a force in these situations which may not be fully encompassed by the idea of event generated scripts.

2. Analysis of significant features of that work.
The organizing principle for the discussions contained herein is the notion of the 'flow of work'. As is argued consistently in the report, the various facets of work activity described below are aspects of a flow which has consequences for the way in which interactions with technology and with customers, often at the same time, are conducted. Two important features of this workflow are examined. Firstly, the significance of continual interruption of a variety of activities by the pressing need to deal with customers, and secondly the organization of work into a cooperative, or teamwork based, activity.

3. Obstructions in the flow of work that stem from current practice in the use of resources.
The study highlights some apparent obstructions in the flow of work that result both from the human/ computer interface and from other activities. The issues that are raised include the organization, use, and distribution of information resources; the paper based status of many of these resources and the problem of locating paperwork; and the unwieldy nature of aspects of the computer interface, most notably the Enquiry Screens. Understanding the 'routine troubles' of staff in dealing with information, and the way in which solutions to troubles are sought, provides insights into developmental routes.

4. Areas where system intervention may add functionality
Where activities seemed to be unnecessarily time consuming, or where they are seen to be obstructive, some suggestions are made as to the relevance of new systems. Particular areas which seem to be promising are ledger work, dealing with customer enquiries, file chasing activities in mortgage work, and specific system operations in cashier work. In particular, understanding the current use of information resources, especially those embedded in Enquiry Screens, and the way in which they are used for these purposes with other staff and with customers sheds some light on the way in which they might sensibly be restructured.

5. Areas where the introduction of new systems may prove problematic without attention to certain issues.
The report introduces some cautionary notes where appropriate, detailing ways in which interface design and database interrogation would need to be attentive to the ways in which cashiers structure their working activities. In the main, this covers the significance of the flow of work as customer driven and its relationship to the speed of transaction; the need for other work to be constantly picked up and put down in response to customer enquiry, some aspects of cooperation in those activites, in that

activities are often engaged in by different people at different times, and to the organization of workspaces and the use of information resources.

6. The direction of future work.
It is evident that relevant and possibly important information remains hidden. Firstly, enquiry into the flow of documents through a number of departments, and the varying uses to which they are put, would seem to be a fruitful avenue for further investigation. Making sense of the formats in which documentation might usefully be presented depends very much on those uses. Since mortgage processing in the Society is presently the provenance of several different departments, of which only one has been examined, it would seem sensible to proceed into those departments. Secondly, much of the routine but nevertheless time consuming administration which takes place at branch level is done for Audit purposes, there might be considerable purchase in a detailed examination of the work of the Audit department.

A fuller account of these arguments is given in the Conclusions and Recommendations section in the main report.

3. Main Body

4. Further Research required.

It is of course always nice to be able to justify further work because you might well get paid for that as well! More seriously, from an organizational point of view, it is just as important to specify the limits of your knowledge- what you don't know as what you do. In one organization we studied, where consultants had been employed to model organizational processes, the comment was made that:

"It's actually hard to decide whether they're telling us anything useful or not, because it's so hard to pin them down ... I can appreciate that it's in their interest to keep what they know close to their chests, because their interest lies in further consultancy ... but we need a specific assessment of what they know and what they don't know ... we can't always tell the difference between knowledge and guesswork, and that's no good to us ..."

5. Appendices.

It is helpful to the reader to put all lengthy extracts into appendices at the rear of the report. Although the data is often interesting, for many purposes it is not central to reader interests. Further, separating data from argument gives an impression of objectivity.

6. Debriefing.

There is of course likely to be a point where not only has a report been presented, but an oral debriefing is required. Indeed, our view is that debriefings should take place regularly to present results and gain a view of what avenues are likely to prove most interesting for the organization. At the same time, debriefing is not always a neutral activity, where facts are simply reported. As a consultant working for an insurance company put it when discussing how best to present data:

"We're convinced we've got some valuable stuff here ... but this is an organization where numbers count .... management here probably won't pay much attention to any data which they don't perceive as objective ... how do we present it so they understand that the data is just as valid ? ..."

In other words, regardless of the ethnographer's opinion of the value of the data, part of its presentation must pay account of management perceptions in the organization. Equally, as the socio- technical systems literature has made clear, organizations can be conceived of in terms of a whole series of alliances; political and career interests; and defensive and aggressive strategies. This is of considerable theoretical interest in understanding conduct, for instance, in meetings, but also can have considerable importance in practical presentational terms for the ethnographer.

"The thing is, there are some people here who won't want to hear this ... they have a stake in the system ... they promoted it in the first place, and not to put too fine a point on it, they've staked their careers on it ..."

That is, presentational matters may have to pay account of the political interests present in the audience. Ethnographers employed on a consultancy basis need to gain some picture of the political interests in play, and indeed they quickly become evident in the course of meetings. They are also, of course, extremely sensitive and cannot be reported on here. For the ethnographer working within and for an organization this is less likely to be a problem.

Which brings us to perhaps the most important point. In the end, people will draw their own conclusions.

Conclusion.

CSCW has by now established a tradition in which the 'situatedness' of work practices has stood as a critique of Rationalist models of process and data. This intellectual critique owes much to ethnomethodology, and of course has led to a demand for data collection and analytic methods which can encompass 'situatedness'. At the same time, there may be something in the argument that CSCW has too easily accepted the intellectual critique of Rationalism at the expense of practical purpose. That is, methods which to some degree at least are associated with Rationalist assumptions may contribute not only to our understanding of organizations but also to the problem of how to change them. Certainly from Taylorism onwards Rationalism has been, and most certainly in contemporary change management approaches is being, applied to practical purposes. Not least, and CSCW has been perhaps slow to recognise this, it has led to a pressure for a demand- led approach to requirements analysis in which business objectives are held to dominate analysis. Such a challenge has important consequences both for CSCW methodologies and for structured design, and yet for the most part neither structured design methods nor CSCW 'alternatives' such as ethnography have come to terms with this. We have aimed to show in this tutorial how there is, as it were, a three way complementarity between data structure and flow, the business process, and the situatedness of work, which remains underspecified in systems design.

It is the ethnographic focus on work that enables us to see things in this way, and as such ethnography ought to be a value component in the study of technology and organizational change. To do so, however, in our view means that a serious re-appraisal of systems design work which emphasises the evaluative nature of large parts of the process. Not least, it implies that some important issues need to be met:

a. Recognising that the design of computer systems is no more or less than an aspect of the design of work and organizations. In other words, the design and evaluation of computer systems alone makes no sense.

b. Recognising that a more comprehensive and inclusive definition of 'system' will be necessary; one which incorporates both social and technical elements and also one which can usefully identify boundaries.

c. Recognising that understanding the 'plan', while not adequate to design is nevertheless necessary. The value of ethnography lies in furnishing comparisons between the 'rational' and the 'situated' elements.

d. By implication, the purposes of I.T. innovation must associate with improving how work is done. This would seem to imply that the system can be usefully evaluated through a focus on how work is done. This value is only released where an analytic focus which emphasises work, rather than process,is furnished by ethnography. Moreover, analysis of work is more than mere description of what goes on, but includes conceptual tools for enabling us to gauge the significance of what goes on.

Unresolved issues

1. The relationship between ethnography and the needs for shortcuts in system design is not clear. It can be argued that some basis for comparison needs to be evolved, especially for the purposes of generic system design. After all, the prospect that each

time a system is intended for ATC, an ethnographic study is necessary because there will be some differences between one centre or another, or because things might have changed over a year or two, is not one that system designers will have much sympathy for.

2. One of ethnography's claims is that it can respecify the nature of the problem in the domain, in that by explicating 'users' methods for dealing with them we gain considerable insight into what, for them, the problems are. Nevertheless, identifying problems is only the first step. Strategies for alleviating problems must also be evolved. This has consequences for Requirements capture, in that whatever the potential solutions to problems might be, deciding between them will always be a normative outcome. Since we have learned that neither customers nor any other interested party has a full knowledge of organisational complexity, nor of what successful change management will look like, issues arise as to the management of the 'voices'. If requirements specification can be read as a gradual move to consensus in its desire for consistency, then there is a danger that some sociologists, and we believe mistakenly, might see their role as a 'strong' management of that consensus. This might range from the quixotic argument that new technologies are always bad, to the view that the political/ethical commitments of sociologists make the best basis for decision- making. In the first instance, this lays ethnography open to the criticism that it can, in some versions, be a 'conservative' rather than 'reformist' approach. In the second instance, the issue is raised of what qualifies the sociologists as 'expert' in the policy field. Our own position, as ethnomethodologists, is that the job involves a fundamental and explicit concern with rigorous description and analysis. However, we should not forget that there are strong prescriptive elements to system design as well, and this may be why some of the other perspectives discussed above can be so alluring. The relationship between design and change management is becoming an increasingly relevant issue, and one that becomes ever more complex. Our own enthusiasm for the work we do, under whatever analytic auspices, should not disguise the fact that no-one has a right to be a soothsayer. 'Reading the Runes' should be left to druids.

Developing Ethnographic Techniques.

"Never Mind the Ethno"

In "Never Mind the Ethno": Where do we go from here?' Tom Rodden and Andy Crabtree argue that as ethnography has become mainstream new challenges have arisen. Ethnography, after a brief period of novelty in CSCW and HCI, is now seen as nothing especially new, it is an everyday part of consultancy and an accepted technique in HCI/CSCW and Software Engineering. There are now a series of research challenges involved in 'moving the method on'; in extending the corpus of studies; in recording and presenting lots of experience; and in seeking to say something in general about design. At the same time technologies are moving on with the advent of wireless technologies, adventurous visions of the future, ubiquitous computing, tangible interfaces, virtual environments, new interaction paradigms and universal information and access. In this view field studies have 'grown up'; field studies have been appropriated in the research community. Meanwhile in our academic and less commercial the focus is on more radical technologies and a growing turn to other disciplines to inspire new methods (e.g cultural probes) and the increasing involvement of product designers. Academic labs and funding bodies are focusing on long term high risk and adventurous. What is the link between studies of work and research that uses technologies that are yet to exist; that postulates user communities that are not around; that involves radical interventions from the arts or design? In recent work associated with the Equator project Rodden and Crabtree argue that they don't even pretend they are identifying a need rather they are exploring a potential possibility. But in these circumstances inspiration is mundane work, and getting a dream to work means it must meet the real world. The central vision is inspired by: Technologies; Art and Design; and Fieldwork. Realising the vision requires a return to the real world and studies to ground, inform and assess design.

This section of the tutorial examines a number of attempts to 'move the method on' firstly in the adaptation and development of 'cultural probes and 'technology probes': and secondly in the use of 'patterns' as a way of developing a way of generalising from field studies to inform design.

Adapting Cultural Probes to Inform Design in Sensitive SettingsA New Challenge

Visions of what technology can do… are rarely based on any comprehensive understanding of needs. (Tweed & Quigley 2000)

This section reports on the adaptation of Cultural Probes (Gaver et al. 1999a) to facilitate research in the long-term and ongoing interdisciplinary research project, Digital Care. The project is concerned to develop 'enabling' or 'assistive' technologies for user groups with different support needs in a variety of residential care settings. Assistive and smart home technology has been shown to enable differently-abled people to lead a better quality of life and to augment the care process (Dewsbury 2001, Dewsbury and Edge 2001). However, many people do not receive appropriate support (Gottlieb and Caro 2000) and there is little evidence of methodological guidance to facilitate the matching of technology to user needs (Doughty 2000, Curry et al. 2001). This section is concerned to address the *methodological problems* that we have encountered in our research and to articulate the solutions we have devised for handling them by adapting Cultural Probes to include a range of unconventional end-users in a formative process of design.

The settings for our project include a hostel for former psychiatric patients, a number of elderly people living at home, and a stroke victim and her family. As a general and important principle, we take it that any technology introduced into sensitive settings such as these should seek to empower users rather than foster dependence on new technology. A technology that merely completes a task for users in care settings does little to promote their independence, but merely shifts reliance onto the technology. This goal raises the very real problem of identifying requirements in highly complex and unconventional domains.

Requirement elicitation in sensitive settings demands that we draw a line between the perceptions of designers - who are often seen to construct solutions and thereby design for people essentially like themselves - and the perceptions of 'the other', which in our case includes a wide range of people who are differently-abled and whose views are effectively excluded from design. As Clarkson and Keates (2001) put it,

It is known that many products are not accessible to large sections of the population. Designers instinctively design for able-bodied users and are either unaware of the needs of users with different capabilities, or do not know how to accommodate their needs into the design cycle.

Consequently, the challenge as design broadens its horizons, moving out of the workplace and into everyday life more generally, is one of including and providing support for a wide range of differently-abled users, rather than creating new technological forms of dependence predicated on remote and abstract philosophies of care.

Developing elicitation techniques that embed a responsive and responsible philosophy of care in the design process requires that we devise new methods for unearthing and accommodating the divergent needs of users with different capabilities. Naturally, this is not a straightforward project, even in light of the long history of participatory design methods developed in the HCI and CSCW communities.

If we take, for example, the hostel and supported housing service for former psychiatric patients and people with severe and enduring mental health problems. It is at one and the same time an organization governed by formal care procedures, a workplace for a company of staff who carry out duties of care, and a home for a heterogeneous collection of patients. It might be taken as a relatively straightforward matter to adopt an organizational perspective and conduct a range of ethnographic studies of staffs' cooperative work with patients in order to facilitate user-centred workshops identifying a host of user requirements informing the iterative development of prototypes (Greenbaum and Kyng 1991). However, staffs' cooperative work is work-with-psychiatric-patients, much as the work of carers for the elderly is work-with-the-elderly and the work of the stroke victim's family is work-with-a-stroke victim. In other words, when we start to investigate the cooperative work of care, we are inevitably and immediately confronted by people with a range of infirmities, disabilities, and impairments, who for variety of highly

understandable reasons may be reticent to subject their lives to the inquisitive gaze of strangers and outsiders - and who can blame them?

The identification of requirements in care settings presents researchers with some obdurate and interesting problems of observation and inclusion, which existing participatory design methods developed in the *workplace* are ill suited to meet. Concerns with such phenomena as workflow, production and efficiency – albeit mediated through direct user participation - give us little purchase on user needs in care settings. Developing methods that are faithful to the *special and unique character* of care settings has long been a general problem for researchers studying differently-abled user groups and are still widely underdeveloped (Gearing and Dant 1990). The paucity of appropriate methods may be attributed to the development of theoretical concepts of need, which are typically abstract, decontextualised, or generic and largely derived from service providers' perspectives, in contrast to the point of view of recipients (ibid.).

Our own preference to the general problem of fidelity is to adopt an ethnographic approach in order that we might develop an appreciation of needs from the point of view of end-users (Crabtree 2003). However, we have found that like existing participatory design methods, the use of ethnographic methods developed in work environments can be problematic in care settings, particularly in the psychiatric hostel where 'observation' can have detrimental effects on the residents. Research in these contexts is often regarded as not merely difficult but often inappropriate and intrusive. The deeply personal, perhaps tragic, nature of such settings places constraints on what can be investigated, as well as how it can be investigated, and raises a very different set of methodological and design challenges as to those occasioned by workplace design. Gathering requirements in care settings demands that we respect the unique needs of end-users and their individual care regimes. Accordingly, we have developed a distinct methodology that combines tried and tested methods of ethnographic study and user-centred workshops with adapted Cultural Probes to explore the care settings and identify needs through the active participation of end-users.

1. Responding to the Challenge: Cultural Probes

They may seem whimsical, but it would be a mistake to dismiss them on that ground: for unless we start to respect the full range of values that make us human, the technologies we build are likely to be dull and uninteresting at best, and de-humanising at worst. (Gaver 2001)

Cultural Probes (Gaver et al. 1999a) have recently gained some prominence in interactive systems design, where they have been employed to explore the design space as computing moves out of the workplace. They were initially deployed in the Presence Project (Gaver et al. 1999b), which was dedicated to exploring the design space for the elderly. Gaver has subsequently argued that in moving out into everyday life more generally, design needs to move away from such concepts as production and efficiency and instead focus and develop support for 'ludic pursuits'. The concept is intended to draw attention to the 'playful' character of human life, which might best be understood in a post-modern sense. Accordingly, the notion of 'playfulness' is not restricted to whatever passes as entertainment, but is far more subtle and comprehensive, directing attention to the highly personal and diverse ways in which people "explore, wonder, love, worship, and waste time" together and in other ways engage in activities that are "meaningful and valuable" to them (Gaver 2001).

This emphasis on the ludic derives from the conceptual arts, particularly the influence of Situationist and Surrealist schools of thought (Gaver et al. 1999a). Cultural Probes draw on the conceptual arts to provoke or call forth the ludic and so illuminate the 'local culture' in which people are located and play out there lives. Cultural Probes are *not* analytic devices but 'reflect' the local culture of participants and are drawn upon to inspire design (ibid.). As Gaver puts it,

[Cultural Probes] offer fragmentary glimpses into the rich texture of people's lives. They allow us to build semi-factual narratives, from which design proposals emerge like props for a film. (Gaver 2002)

Recent work in the Interliving Project (Hutchinson et al. 2002) has seen the adaptation of Cultural Probes to Technology Probes to embed inspiration *in* the design process, in contrast to providing inspiration *for* design. Technology Probes situate existing technologies in users homes in order to inspire design by exposing users to new experiences. In this respect, technology is taken to 'act as catalysts for new design ideas' (ibid.). While this new participatory design method may be of broad benefit, we have to be very careful about introducing new technologies into sensitive care settings. There are number of reasons for exercising caution, ranging from moral concerns with unforeseeable and potentially disturbing disruptions to the fabric of the local culture, to practical concerns with the theft of expensive equipment - a very real concern in the hostel, for example, where residents were often attacked and robbed or might otherwise sell the equipment to get a little extra income. Whatever the reason, caution needs to be exercised where the introduction of technology into care settings is concerned - a situation that raises a distinct challenge for participatory design approaches, many of which are predicated on exploring the design space through direct technological intervention.

Wary of the potential risks of hasty technological intervention, we have elected to adapt Cultural Probes through the use of social research methods to sensitise design to participant's local cultures and so inform the elicitation exercise. We are particular concerned to understand the practical activities, practical circumstances, and practical reasoning 'at work' in our participant's local cultures in order that we might understand user needs within the context of their daily lives (Garfinkel 1967). We wish to adapt Cultural Probes, then, into devices with which we might pay the most commonplace activities of daily life the attention usually accorded extraordinary events and so come to learn of the needs of differently-abled users as phenomena in their own right. Combined with more traditional ethnographic methods, we see adapted Cultural Probes as vehicles enabling researchers working in sensitive settings to maintain fidelity to the phenomenon.

Developing an understanding of such phenomena as old age, disability and mental impairment from *within* the settings they inhabit, and from the point of view of people effected by them, is no easy matter since care environments in general tend to be much more private and personal places than work settings. Indeed, the presence of an ethnographer kitted out with standard research tools - tape recorders, videos, and notebooks – may, on occasion, not only be unwelcomed and disconcerting, but also highly damaging: consider the potential effects of such an intrusion for somebody suffering from paranoid schizophrenia, for example. Adapting Cultural Probes allows researchers to *supplement* the understandings developed through ethnographic research in situations where intrusion and disruption are likely to arise. In the following section we report on the ways in which our adapted probes have served as provocative resources, calling forth and illuminating the rich textures of our participants everyday lives.

2. Adapting Cultural Probes: Moving From Inspiration to Information

For Gaver and the other members of the Presence Project, Cultural Probes inspire design by providing …

… a rich and varied set of materials that … let us ground [our designs] in the detailed textures of the local cultures. (Gaver et al. 1999a).

These materials are products of the probe packs, each consisting of a variety of artefacts including:
•   Postcards with questions concerning participants' attitudes to their lives, cultural environment and technology.

- Maps asking participants to highlight important areas in their cultural environment.
- Cameras with instructions asking participants to photograph things of interest to them and things that bored them.
- Photo Albums asking participants to assemble a small montage telling a story about participant's lives.
- Media Diaries asking participants to record the various media they use, when, where and in whose company.

These artefacts provide a range of materials reflecting important aspects of the participant's local cultures and, on being returned to the investigators, these reflections inspire design.

Our own probe packs (Figure 1) consisted of a similar but more extensive array of devices, including:

- A set of postcards addressed to the researcher - for residents to write about their daily concerns, interests and ideas.
- A map of the local area - to provide some sense of geographical routine as well as areas residents felt unsafe.
- A polaroid camera - to take photos of their room, their friends and visitors, things that were important to them - that they could then put in the photo-album and annotate with post-it notes
- A disposable camera - to take more photos for the researcher to develop and provide a focus of interest for subsequent discussions and interviews
- A photo album
- A voice activated dictaphone - for residents to record a diary of their activities, ideas and thoughts
- A visitors book - to provide some sense of the rhythm of activities and visiting
- A scrapbook, 'post-it' notes, pens, pencils and crayons - to enable residents to draw diagrams of their homes and its layout, as well as present ideas in pictorial form.
- A personal diary to record the participant's daily activities.

These were handed out, much like a birthday or Christmas present, and their use was explained to the participants: "*These items are 'cultural probes' - but don't worry - they're just a way for us to find out more about you, your everyday life, what you think and feel. We'd like you to use them to tell us about yourself - and below are a few ideas you might want to think about. Ignore these if you like - nothing is compulsory - do as much or as little as you like. We hope its fun. I'll come back to collect them in about a week*".

The probe packs also contained a set of instructions and some suggestions as to how the various devices in the probe pack might be used. For example,

Draw on the maps and use post-it notes to indicate where you feel safe or threatened, favourite places, or places you avoid.

The diary can be used to record daily events and activities as well as visitors that you get. You can write in it whatever you like and wish to tell the team.

In the case of the elderly, a booklet was provided rather than a set of instructions in order to provide a more enjoyable focus the activity and also to provide a gift that we could return as a reminder at the end of the project. The booklet asked elderly participants to describe which rooms were used most often, their favourite activities, activities they would like to do or missed being able to do, the various kinds of technology they used, and so on. The stroke victim and her husband also allowed a researcher to record parts of their daily household routines on video.

Figure 1. Informational Probes Pack

Our probes kits, whilst consisting of many of the same artefacts, perform a different function to Gaver's Cultural Probes. Where Gaver's probes are intended to reflect participant's local cultures in material detail and in that detail somehow - but *unaccountably* just how - inspire design, ours are intended to meet the more modest and traceable aim of supplying information to inform and shape design. While inspiration would undoubtedly be a bonus, our prime concern is informational – a matter of gaining insights into how people live their lives, their everyday circumstances, their routines and rhythms, their practical concerns, and so on. We have an analytic concern in our participant's lives – one that is concerned to explicate and make visible the *situated* character of old age, disability and mental impairment (Garfinkel 2002). The analytic contrasts with theoretical approaches, which seek to develop abstract, decontextualised, or general models of disability and provides the opportunity to develop technologies that are responsive to the real world, real time context of use.

In contrast to Gaver's approach, rather being treated as 'reflections' of participant's local cultures, the materials returned by our probes were instead treated as resources facilitating cooperative analysis using the materials to facilitate and focus various user workshops. These in turn supported the 'co-realization' of design solutions supporting and attuned to their needs (Hartswood et al. (to appear)) and reflecting some of the processes of 'domestication' and 'innofusion' (Fleck 1988, Williams et al 2000).

However, we would not like to make too many claims about the novelty of our methodological approach - though there is novelty in its application to these settings. Cooperative analysis of the material exploited several existing and related methods of social research, including biographical interviews (Gearing and Dant 1990), visual biographies (Prosser 1992, Harper 1996), and technology biographies (Blythe et al 2002). Technology biographies, for example, are designed to generate critical and creative responses to questions of home technology development, focusing on past developments and historical trends that are of personal importance to the respondent; current uses, problems and concerns. These methods also have some similarities with longstanding social science diary approaches that have also been employed in HCI research (Brown et al. 2000). Concentrating on the situated character of participant's local culture rather than their information-seeking activities, however, this combination of complementary methods enabled us to develop a more comprehensive understanding of the 'life-worlds' of our users.

We have found that these analytic methods enable potential users to participate in the design process in a readily accessible way and reflexively trigger a design dialogue that is deeply attuned to their practical circumstances and needs. The probe materials on which the methods trade are resources of a kind that require, as Harrison (2002) puts it, the collaboration of the participant to 'translate' their meaning. Taken together, the various biographical approaches we have employed in our Informational Probes have encouraged participants to reflect upon and articulate important personal,

social, and technological features of their everyday lives. These reflections, in turn, have enabled designers and participants to articulate and elaborate the role of design in the local cultures that make up our studies.

3. Informing Design: The Emergence of 'Abiding Concerns'

Tap into whomsoever, wheresoever and you get much the same thing. (Sacks 1984)

The probe returns – including photographs, maps, drawings, diaries, postcards and the rest - introduced the design team to salient issues in our participant's lives and provided a concrete and enjoyable focus for subsequent user workshops. Of particular interest, our ethnographic studies and Informational Probes have indicated some major preoccupations or 'abiding concerns' that occur across the different care settings we are studying, such as a preoccupation with *safety and security*.

At the hostel, for example, residents have been subjected to frequent physical and verbal attacks. This has resulted in the gates being locked at four o'clock each day - when the school day ends - and some residents will only travel outside the hostel by taxi. Consequently, residents are increasingly cut-off from the outside community and their friends. A concern with safety and security outside the home is also reflected in the diary entries of elderly people and is manifest in reduced social contact. These unfortunate circumstances pose fascinating, if distressing, problems for design, highlighting the importance of connections between the care environment and the outside world.

Managing medication appears to be another abiding concern. It is quite common amongst people with strokes, for example, for them to have other illnesses
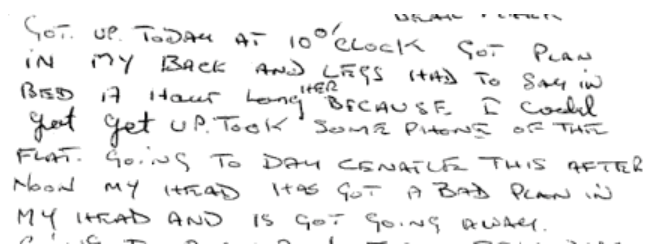

Figure 2. Dorothy's Daily Medication

and attendant medical problems. In Dorothy's case she has, amongst other things, late onset diabetes, this complicates matters as far as her dietary and medical needs are concerned (Figure 2). The drugs prescribed to treat both her stroke and diabetes are, to a certain degree, mutually antagonistic and require constant monitoring.

Figure 3. Dorothy's Medication Chart

Her diet, meal times and exercise must be planned and monitored closely as together they not only affect her glucose levels and insulin intake, but also have some bearing on the efficacy of some of the other drugs she takes. In practical terms this means her body signs must be closely checked three times daily in order that future dosages of drugs can be calculated. In short, in light of Dorothy's past condition, decisions regarding the amounts of each drug that make up the ingredients of her medicinal cocktail - some 30 plus doses of 8 to 10 different drugs - must be made throughout the day. Monitoring this is an abiding daily concern, accomplished by family members who track Dorothy's medication through the use of a shared medication chart (Figure 3).

In the hostel, medication issues are similarly a focus of much concern. The medication regime plays a central role in the maintenance of 'normal daily life' for many persons suffering from psychiatric conditions. Many of the residents are on daily medication regimes and expressed their concerns about the consequences of forgetting to take their medication. In the semi-independent living area residents are expected to manage their own medication and weekly supplies are provided by the pharmacy, packaged into individual doses within a plastic container. This arrangement often causes anxiety since residents, who have previously relied on the staff to provide their medication at the correct time, must now depend on themselves. These concerns are echoed in the returns from the probe packs - in the postcards, for example, which persistently focus on issues of illness and pain (Figure 4) and in such things as photographs of food cabinets, where a list is displayed of foods particular residents need to be wary of for medical reasons (Figure 5).

Figure 4. Postcard from a resident

The probes also provide us with insight into the daily routines that provide for the 'articulation' (Schmidt and Bannon 1992) or *coordination of activities* making up 'daily life' in particular settings. As Tolmie et al. (2002) suggest,
There is a sense in which routines are the very glue of everyday life, encompassing innumerable things we take for granted such that each ordinary enterprise can be undertaken unhesitatingly. Routines help provide the grounds whereby the business of life gets done.

Routines reveal what Zerubavel (1985) regards as the 'temporal rhythms' of social life - a notion that provides a way for us to think about person's everyday activities: visiting people, going shopping, taking medication, etc., repeating activities over time until they get absorbed into and become part of the routines making up and articulating particular care settings. The notion helps us understand aspects of everyday life in these settings by highlighting its intrinsically temporal and cyclical nature.
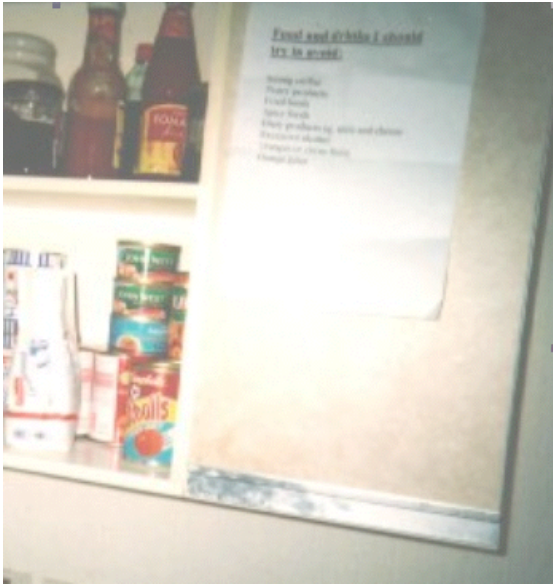
Figure 5: Food Instructions - what to avoid

In the everyday life of the hostel residents, for example, a number of rhythms can be readily perceived - visiting rounds, movement of residents into, around and out of the site at various times of day, medication delivery, resident and staff meetings, and so on. Such rhythms were not only important to the staff for coordinating their work but also for the residents, serving both a communicative and a therapeutic function. Knowing that events should happen in some sort of regular and predictable order, what people were doing, and where they were from, was of value to both staff and residents. Amongst the elderly we have found that such rhythms played out in visits to the Church, the visits of friends and relatives and the 'pottering about' of daily routine that are documented in the diaries (Figures 6 and 7). The rhythms and modulations within the home produce differing messages as people age. While certain aspects of daily life appear characteristically standardized such as getting up after going to bed, having meals at certain times etc, the *detail* of such patterns change throughout the life cycle. Eating times and bedtimes, for example, change with age as do most activity patterns, for example, a doctor's appointment at 9.30am may require that an elderly person get up two hours earlier in order to get ready.

The rhythms of daily activity not only orient people to their present activities, but to their future activities and the requirements of those activities. Knowledge of the setting's daily routines allows them to plan their activities. Technology is required to fit into these temporal regularities or rhythms in order to provide some degree of predictability and, with that, stability to the inhabitant's life (Tanzi 2000, Edwards and Grinter 2001). The temporal rhythms within a setting are organizing rhythms and technology is obliged to support them if it is to be responsive to the subtle changes that occur throughout the participant's day.

Figure 6: Diary entry describing daily rhythms

Through the adaptation of Cultural Probes to Informational Probes we have been able to illuminate the rhythms of daily life at work in the various settings in our study as well as the possible problems and difficulties that individuals face therein. What has emerged from our investigations, even those as unconventional as community care settings, is that everyday life is made orderly by members through the accomplishment of routine activities that reflexively give rhythm to their lives. What transpires from the Informational Probes, what is made visible then, is the gross transparency of social order in each and every domain within which participant's lives are organized, both by themselves and in their interactions with others.

From our perspective, design interventions are unavoidably interventions into the orderliness of everyday life - an orderliness that is massively obvious in, for example, the diary entries. Design directly affects everyday activities in various ways by impacting on timeliness, reliability, dependability, safety or security, for example. Figure 7, for example illustrates the daily rhythms of a respondent who notes in her diary that her life is punctuated by periods of rest. Consequently any technology support must be sensitive to the times when she needs to rest and when she has the strength to continue.
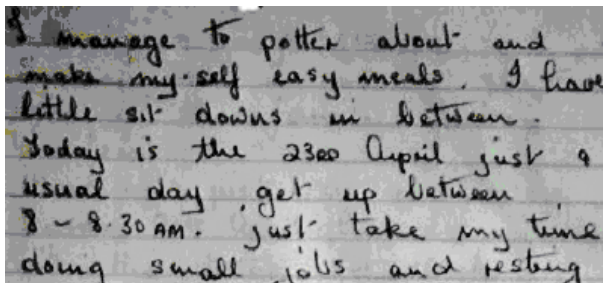
Figure 7: Diary entry

By paying careful attention to the orderly features of participants daily lives in sensitive settings – by attending to the rhythms, routines, and abiding concerns manifest in participants daily lives – an appropriate philosophy of care might be developed and integrated into the design of technologies for sensitive settings in much the same way as other philosophies, such as the Scientific and the Modern, have already been incorporated.

Although our research is ongoing, following the issues raised through observation, interview and the items coming back from the cultural probes a number designs and prototypes have been developed and deployed. They focus on various forms of awareness to support a variety of abiding concerns and temporal rhythms, such as supporting the timely taking of medication. This includes the design of a GPS 'panic alarm' for residents; a prototype medication manager and the design and deployment of a messaging system. The medication manager, for example (reported in more detail in Kember et al 2002) was a product of staff and residents concern about the possible grave consequences of them forgetting to take their (often powerful doses of) medication. Observation and interview and the probes confirmed the important role of the medication regime in the maintenance of normal everyday life. The kinds of issues that emerged from the research included dosage, delivery, reminders and reassurance and were highlighted by some readily expressed and graphic fears and anxieties, from residents and staff, over the possible consequences of forgetting their medication or overdosing. Our prototype focused in particular on the residents in the semi-independent living site who have previously relied on the staff to provide their medication who must now - as part of the move to independent living - remember what to take and when. The paradox (at least for technology designers) was that the technology needed to fit in with the professed aims of the unit - moving towards developing independent living skills - to act as simple 'reminders' to residents to take their medication rather than shifting their dependence from the staff to the technology.

Special consideration needed to be given to the design of the application, that took these factors into account as well as others such as the place for the artefact within the lifestyle and living space of the user (as revealed in the probes). As the focus of this section is *methodological*, however, this technical work, and the precise ways in which the probes and ethnographic studies informed the designs, is reported elsewhere (Cheverst et al. 2001, 2003; Kember et al. 2002).

4.   Problems with Probes

Despite our successes, the use of probes has not been entirely problem free. It is the analytic problems that we are primarily interested in, rather than what might be regarded as the apparent triviality of the returned probe material. (And it would be surprising if much of the material would seem, at least to an outsider, as trivial) With probes, Cultural and Informational alike, there seems to be an inherent problem of confusing just what the data is and, with that, just what the focus of analysis is. It is *not* the material artefacts of the probes - the tapes, the photos, the booklets and diaries, etc. – but rather, the *situated character* of everyday life in various care settings as elaborated by *participant's accounts* of their daily rhythms, routines, and abiding concerns. Such accounts supplement and augment insights gained from direct observation and are generated through cooperative analysis of the returned probe material. Probe materials serve as triggers for analysis then and in asking people to administer them we transform participants into active enquirers into their everyday lives, rather than passive subjects of our research.

While we believe that overall the probes have proved successful as a means of including our unusual and often ignored groups of users in collaborative analysis of the design domain, and of elaborating that domain from within, we acknowledge the problems we have faced and recognise the need to think carefully about the claims and expectations for any method. So far it is undoubtedly the case that our respondents have enjoyed using - and misusing - the probe packs: one camera has been stolen and in another case the polaroid was used to take naked pictures (primarily of bottoms), for example. Nonetheless, and as Gaver puts it, the probes have …

… provoked the groups to think about the roles they play and the pleasures they experience, hinting to them that our designs might suggest new roles and new experiences. In the end, the probes helped establish a conversation with the groups, one that has continued throughout the project.

For our part we would add that they have also provided a great deal of information and insight into participant's daily lives in sensitive settings, which provides the basis for 'continuing conversation'. We would be wary, however, of making any grand claims for the methods we have presented – that it enables us to engage in some kind of emancipatory programme of reform, for example. Such things have always seemed to us to be an outcome rather than precursor to research. In a similar fashion, we would dispute any suggestion that in lacking the personal circumstances or disability of those we study, our accounts are biased and partial. Whilst we make no claims to be Geertz's (1973) chameleon fieldworkers - some 'walking miracle of empathy, tact, patience and cosmopolitanism' - nor will we confuse experience with understanding. Instead, we share Fennel et als. (1989) preference:

For studies which bring researchers into direct contact with their field, but the real criteria for research studies are that they should be systematic, open-minded and openly reported. If these criteria are met, readers can decide safely for themselves how to treat the results.

5.   New Directions in Interaction Design

I can tell you something but you have to be careful what you make of it. (Sacks 1992)

"..it is now apparent that the 'universal types' of much 20th century design failed those on the margins of society - especially as assumptions about what is 'average' or 'normal' have been too often based on the stereotype of the young, fit, white, affluent male. " (Clarkson et al 2003)

It appears to us that there are interesting and challenging changes occurring in the design landscape and, as Clarkson et al (2003) suggest in their work on 'inclusive design', this challenge may well be "one of the defining business priorities of the age'. Of course, our interests lie in research rather than business but the messages that have emerged from investigating new and ubiquitous technologies in novel settings are compelling nevertheless as we look for resonance between design and the diverse needs of different groups, for applications and artefacts that are of inherent value rather than merely new. As Clarkson et al (2003) cogently put it:

' A growing interest in how people interact with products and services, especially in terms of emotional engagement, combined with a awareness of the breadth of individual capabilities across the life course and the cultural diversity of modern communities, has obliged designers to rethink assumptions about who their typical consumer is likely to be." (Clarkson et al (2003)

In moving out of the workplace towards design in sensitive settings - or 'design with care' as we have called it - we are required to make a perceptual shift in order to determine the needs of the differently-abled and to reflect these within the design process. Designing with care demands the development of inclusive strategies and elicitation methods. While there is great promise that technology will enable and assist users in care settings, it is of fundamental importance that designers recognise that solutions devised on the basis of inappropriate investigative strategies and methods can be debilitating, dis-empowering, and de-humanising.

When considering design for care environments, we have found that traditional technological approaches such as ethnography need to be supplemented. Informational Probes may prove a useful part of the researcher's repertoire, particularly where information and insight into the unique needs of novel domains is required. Our use of Informational Probes in a number of sensitive settings has led us to appreciate their value as an important first stage in the requirements gathering process. Promoting collaboration, they work to actively involve users in the design process, rather than cast them as docile victims of research and passive recipients of design. It should be said, however, that these clear benefits aside, Informational Probes like Cultural Probes before them provide no 'silver bullet' for design: they do not tell designers what to build or provide a convenient recipe for translating fieldwork insights into technical applications. But then, as far as we are aware, neither does any approach to date and the problems of moving from study to practical design recommendations and applications remains as obdurate as ever. As we suggest, probes are, or can be, the first stage in an ongoing and difficult process of design but they at least provide some insights into user needs and perceptions as well as a method for ensuring the early, active, involvement of users in the whole design process.

We have long been strong supporters and practitioners of ethnographic research, and it is important to appreciate that many of the methods implicated in the administration of Cultural and Informational Probes are thoroughly ethnographic in character. Tied to an array of analytic methods, the use of diaries, notebooks, cameras, and the like has a long history in ethnographic research. As the ethnographic methods devised to support workplace design have 'grown up' and 'left home', being absorbed into the

standard repertoire of design, we find these old practices returning to the fore, being appropriated by new disciplines, dressed in new clothes, and refined in order to address the research challenges that are emerging as design moves out of the workplace.

The challenges of contemporary research are both methodological - being concerned to move method on and develop it for new uses - and analytic - being concerned to provide new and useful insights into novel design domains. The need for new methods is a product of a changing technological landscape and priorities, which have prompted design to turn towards other disciplines, particular the Arts, to inspire design. While Cultural Probes may well inspire the development of radical technologies and adventurous views of the future, getting such imaginative visions to work generally means that they must, at some point in time, meet the real world and engage with new users if design is to be to sufficiently grounded. It is in this context that we believe Informational Probes have something to contribute to foundational research in contemporary design more generally.

TECHNOLOGY PROBES: GETTING DATA FROM SPAM

In a number of papers (Cheverst 2003 b, c) we have outlined a range of factors that conspire to render our usual ethnographic data collection techniques inappropriate and how we have sought to supplement our understanding of the care setting 'from within' by adapting Cultural Probes. Cultural Probes (Gaver et al. 1999) have achieved some prominence in interactive systems design, where they have been employed to *inspire* design as computing moves out of the workplace and into everyday life more generally. In contrast, we have elected to adapt Cultural Probes through the incorporation of social science research methods to *gather data* about participants' daily lives. Our Informational Probes have been employed to sensitise parties involved in design to the local cultures within which new technology will be embedded and to elaborate the needs of users. With SPAM the technology also acts as a probe – i.e., as a means of gathering data. The text logs generated provide us with a complementary source of information, which may be used to measure and assess the functional value of our systems from the point of view of day-to-day use.

The notion of Technology Probes has recently been employed in the Interliving Project (Hutchinson et al. 2003). They describe the use of a technology probe as threefold:

Technology probes are a particular type of probe that combine the social science goal of collecting information about the use and the users of technology in a real-world setting, the engineering goal of field-testing the technology, and the design goal of inspiring users and designers to think of new kinds of technologies to support their needs and desires. (Hutchinson et el. 2003)

Technology Probes seek to embed inspiration *within* the design process, in contrast to providing inspiration *for* design. In this paper, we concentrate on Technology Probes as a response to Hutchinson et al's (2003) first goal: collecting information about use and users in a real world setting. The SPAM technology has non-intrusive logging functionality that is not immediately apparent to the user, although all participants were informed that logging was taking place. Here we see as central to the notion of Technology Probe the possession of embedded, invisible, non-intrusive functionality enabling the monitoring of ongoing use of technology by users.

The SPAM machines perform their logging functions by appending messages to a plain text file. The SPAM application runs on a stand-alone miniature PC and all messages to log are generated by the SPAM main application. The GSM terminal is interfaced though a Java class sending and parsing AT commands, so much more

debugging information about communication with the GSM terminal is available. This enables information sent to and from the GSM terminal to be logged.

Figure 3a shows a sample of the log file entries generated by the SPAM system for a message sent to Location A from Location B, figure 3b shows a sample of the log entries generated at Location A when this message arrives. This is a mixture of debug output from communication with the GSM terminal, and 'higher-level' messages indicating that a message has been sent, received etc.

```
ok_pos
Waiting for lock on JGateServer
Got lock on JGateServer, about to send: ps would you like any pizza for tea to
2:-1:-1:-1:-1
2:10:-1:-1:-1
ok_pos
set text mode - OK
2:18:-1:-1:-1
ok_pos
set TE notification - OK
About to send  ps would you like any pizza for tea t ): 07766345014
Got is now: AT+CMGS=
1:-1:-1:-1:-1
Got is now: AT+CMGS="0776634
1:-1:-1:-1:-1
Got is now: AT+CMGS="07766345014"

1:-1:-1:-1:-1
Got is now: AT+CMGS="07766345014"
>
1:-1:-1:-1:-1
sms_prompt_pos
Got is now: ps would
```

Figure 3a: Log of message sent from Location B to Location A

```
"REC UNREAD"
sender: +447788433624
date: 02/10/25
time: 17:05:04
message: ps would you like any pizza for tea
2:-1:-1:-1:-1
2:-1:-1:-1:-1
2:-1:-1:-1:-1
2:-1:-1:-1:-1
2:-1:-1:-1:-1
2:-1:-1:-1:-1
2:-1:-1:-1:-1
2:-1:-1:-1:-1
2:-1:-1:-1:-1
2:-1:-1:-1:-1
2:10:-1:-1:-1
ok_pos
Delete successful
Message: ps would you like any pizza for tea From: +447788433624 Time: 17:05:0
Update :Message: ps would you like any pizza for tea From: +447788433624 Time
Send message:
2:-1:-1:-1:-1
2:-1:-1:-1:-1
```

Figure 3b: Log showing message received at Location A

Working with Logs: Technical Issues

One initial technical issue was what information to log, as it is difficult to predict which information may be useful. It is sometimes obvious from the outset which information will give the best clues about use, though it may not be apparent until thorough analysis of the logs what additional information it would have been useful to collect. Additionally there are limits on the amount that can be collected, so a balance is necessary between what is essential and what is possible to store. In general our policy is to collect more information than may appear necessary. The safe storage of the logs is another important technical issue that needs to be addressed since the

SPAM units are very compact machines, making it very difficult to add additional redundant storage, e.g. extra hard drives.

When we attempted to analyse the SPAM logs to look at the dialogue taking place, we found this an unexpected challenge. After attempting various means to parse the logs in different ways, programs were written to extract messages sent and received from the SPAM logs and place them in separate text files, separating and formatting the entries. Initially it was very hard to follow the chronological order of dialogues using two separate files for messages sent and received, so the analysis program was modified to output to a single file. Unfortunately we found that only the time and date of messages *received* had been logged, not the time and date that messages were *sent*. The SPAM system does provide an acknowledgement reply SMS message when a message has been read, this means that usually the next entry in the log gives a good approximation of when the previous message has been sent. This is obviously not ideal, and makes analysis of the logs more difficult, as the acknowledgement entries in the logs make it harder to see the actual messages being sent and received (and should ideally be filtered out). Our solution to this problem has been to modify the analysis program to make the acknowledgement entries much smaller (so they only take up a single line), and to highlight by hand the messages sent and received using different coloured marker pens. Additionally we performed a 'find & replace' to add names to known mobile phone numbers.

Rating the Logs: Problems with Ongoing Use

One of the key issues with texting systems, is the need for users to have a strong trust in the reliability of the system – i.e., that any SMS text message sent to a situated display will (indeed) appear and remain there for an appropriate period of time. In the absence of such dependability any interpretation of the data from the technology probes is, at best, problematic. Of course, in order to encourage users to trust the system, they need to see the system functioning correctly over a protracted period of time. We have found achieving this kind of dependability difficult. It has been interesting to observe how some users have developed coping strategies to deal with early reliability problems. Providing users with appropriate feedback is of paramount importance when supporting interaction and is one means for tackling the complex dependability requirements inherent in systems such as SPAM – the quantum leap in difficulty of building and deploying systems that need to be operational on a constant basis. Crucially, we believe that it is important to deploy such systems in the long term. Even a relatively simple technology can result in complex and unanticipated use over time (O'Hara et al. 2003). Users also require sufficient time to domesticate the technology by adapting it to particular features of the domain and/or to develop new forms of use ('innofusion' Fleck (1998)).

5.3 Interpreting the Logs: Problems with Analysis

One of the problems with working with the logs has been the indexical nature of many of the messages examined. Some success has been achieved in eliciting general themes from the logs using grounded analysis techniques (Strauss, 1987). However, because the embedded logging technology is situated in the fabric of the workplace, an understanding of that 'fabric' was often required to successfully interpret the subtleties of the interactions: e.g, understanding that "*mu 2 bol 2 cheeky*" represented the score of a football match. An additional problem, given problems encountered with successfully logging times and dates, was understanding ongoing interaction: when exchanges began and ended and how individual exchanges were related. Finally, because SPAM only logged where the message was sent from and not who sent it, understanding the subtleties of interactions was challenging.

Understanding User Experience with SPAM

This section presents some reflections on the data we have obtained from the 'Technology Probes' in the SPAM system. Despite the difficulties of extracting coherent data we believe that some interesting and important material has been produced. Our emphasis has been on studying technology in use, and our interest is in understanding the data on texting as 'everyday occurrences', as constituent features of ordinary workaday activities. The point of this is to examine the data to see what details it provides of how the technology is 'made at home' in the settings it inhabits and how it comes to fit into and resonate with everyday work. Our concern is with how this technology finds a place within, and is responsive to, the 'working sensibility' of a setting. This interest and the kind of data collection it requires is, perhaps, remote from the kinds of general *reflections* that someone in an occupation might produce, and much more attuned to their consciousness and attention when they are actually *engaged* in their work. The embedded, invisible and non-intrusive nature of the 'Technology Probes' described here is a response to this concern. In particular we are interested in the use of texting in the exercise and development of users' *working sensibility* and especially how and in what circumstances they react to or decide to initiate texting. The development, deployment and evaluation of the SPAM system have revealed a number of interesting issues in this regard.

Having installed the text messaging equipment, ensured it functioned, and demonstrated it to users, the systems have now been in use for over a year. Without necessarily subscribing to the fetishization of quantitative data, our analysis to date has been hampered by an inability to easily compile statistical data on usage and so analysis has largely been based on a time-consuming manual examination of the logs. This suggests that current usage seems focused on:

Awareness (e.g., "Has fax, email got through? Has X left yet?").

Coordination between sites (e.g., "I keep ringing and nobody answers? Can you ring me please"; "Pizza & and chips ready come on in ☺").

Coordination between staff (e.g., "Please ring car wont start"; "Alison can you ask terri to ring me when she comes in about the swop").

Tracking schedules (e.g., "What shift is steve doing tomorrow and where"; "Alison on visits and has mobile. Brian out with hh and has own mobile"

Queries (e.g., "Which keys should we hand over?"; "Can I possibly get a lift into town").

The SPAM logs reveal a growing familiarity with SMS or 'textspeak' (e.g., "What does 18tr mean?" - "Later in SMS speak, get with it babe") and its use to tell jokes (e.g., "how do u turn a duck in2 a soul singer: put it in the microwave until its bill withers") suggests the technology is slowly but surely becoming *organizationally embedded* in the day-to-day work of the residential care setting, as the following extracts also indicate:

"SORRY IM GOING 2B LATE DARRIN"

"Blocked in snow will be late"

"Snow problem please ring Barbara"

"Penny am with mr gate closed bvt not locked"

"Hold up with s m money will be delayed back a s a p Barbara"

As these examples illustrate, the organizational character of texting consists of an explicit *sharing of context* in order to support (or potentially support) collaboration with others.

Like Nardi et al. (2000) we are interested in understanding the communicative *functions* of texting - of the use of texting for quick questions and clarifications, for

example (e.g., "Do you know if Helen has any medicine"; " Wot time is Paul calling to c hh"). Similarly, there is evidence in the logs that texting is useful for various kinds of coordination. Texting is particularly useful to coordination when immediate responses are required (e.g., "D ... XXX has to have blood test at cc at 10 30 i will take him can you tell him to be ready - let me know if you have got message" - "Got message have cancelled his taxi"). However, the use of text also extends to coordinating the use of technology when, for example, a conversation is complicated and/or involves too much typing (e.g., "Please phone house when you are able"). In other instances texting is relied upon when other technologies (phone, fax, email, etc.) are in use or are being kept clear in the anticipation of urgent use and to alert others on occasions where technical failures occur (e.g., "Put the phone on to answerphone"; "Please switch the mobile phone on"; "u r blocking the phone line after someone telephoned here it sounded like mike. Please sort out as we can not use the mobile if needed").

What becomes obvious in reading the text logs is the flexibility of text messaging in terms of supporting the everyday work of the hostel. The expressive' character of texting is also noteworthy. Even without the addition of emoticons, our users routinely employ texting for affective communication about work, work crises, jokes and general social banter.

"I can hear a kind of jingley sound and there are animals on the roof what does this mean?" "It means that Santa is passing over the house and making his way down to see me"

"Help please its all too much on my first day back"

"Hello ian i was wondering if everything was alright?"

"A man went to the doctors with a lettuce up his bum and the doctor said its just the tip of the iceberg im afraid"

The affective character of texting has been observed by other researchers in other settings (Taylor and Harper 2002). As Nardi et al. (2000) put it,

It is interesting that a lightweight technology consisting of no more than typing text into a window succeeds in providing enough context to make a variety of social exchanges vivid, pleasurable, capable of conveying humour and emotional nuance.

Of particular interest to us is what Nardi et al. characterise as 'outeraction', where text messaging does more than support rapid informal communication but also facilitates practices that make communication possible. Such practices include negotiating the availability of others for conversation (e.g. "Please phone the house when you are able"). Such negotiation requires some sensitivity towards the work and pace of work of others and involves recognizing appropriate and inappropriate times to contact others, appropriate modes of interruption, and so on. Texting allows people to address the kind of issues on which communication turns in that it is less obviously 'in your face' than some other forms of communication. It permits delayed response or easy acknowledgement (pressing the acknowledgement button), for example, and at the same time facilitates multi-tasking, allowing workers to monitor texts whilst engaged in other jobs. The logs suggest that texting in the hostel allows workers to negotiate their availability and maintain their connection with the rest of the staff. Knowing who is around, what people are doing at weekends or during sleepovers at the main hostel, for example, enables workers to establish and project a range of possible interactions, much as the door displays at the university allow people to project appropriate course of action in response to messages left by staff. Texting, in other words, enables users to *plan* joint activities as much as it enables their coordination.

Concluding Remarks

In this section we have commented on some of the difficulties we have faced in our deployment and use of 'Technology probes' as an attempt to log activity and use of an SMS application. From a technical perspective we have certainly found that managing and maintaining the logging functions of the SPAM system has raised some unexpected challenges. We have certainly learnt that appropriate support for logging needs to be considered at design time given the potential implications that appropriate support for logging can have on system design. One requirement that is perhaps more peculiar to ubicomp systems (given the potential range and number of sources of logging information) is the need to consider the design of appropriate tools to support the amalgamation of separate logs and the need to support human augmentation (e.g. categorising data in the logs) of these logs, we have found this latter requirement to be a key requirement for analysing usage patterns from SPAM. Supporting an automated categorisation process certainly poses an interesting AI challenge.

For the social scientists on the project, the logs provided a valued and worthwhile resource that supplemented existing social research techniques. This supports Hutchinson's et al.'s (2003) findings. However, rather that understanding the logging as mainly inspiration for design, the value of the logs has resided in providing a record of and thereby facilitating our understanding social action and the members' standpoint in real time. People cannot know how their activities will turn out – whatever their intentions and best efforts accidents and mistakes sometimes occur – and these happen in real time. Consequently getting a better understanding of the actor's point of view – which is the essence of this approach to usability – requires the examination of the organisation of social action *over its course*. The actor's point of view is temporal and resides in unfolding action. The logs present an opportunity to understand such contextuality. A basic feature of our investigations, regards the social actor as a *practical doer*, needing to get things done. The logs tap into the fact that everyday activities possess an essentially temporal character; for lacking the benefit of hindsight the actor's point of view is always located as some *here and now* within any particular course of action.

Even the idea that something is part of a course of action is integral to the *production* of the course of action itself. That is, determinations the actor makes *as part of the means of carrying out the action* as to 'where I am now'?, 'how much have I done?', 'is this course of action working out as I anticipated or do I need to adjust the prepared course', 'how much more is there left to do', 'how can I get from doing what I am doing now to doing what I need to do next?', 'what do I need to do next, exactly', etc. To the extent to which the logs reflect and document these kinds of processes we have found them invaluable. This is not to suggest that either getting or analysing the data is easy, for the data is *indexical* to the activities that generated it. Knowledge of those activities – obtained through our other researches – is brought to bear on analysis of the data and to make sense of it – to make it meaningful. In other words, the data depends for its adequacy on knowledge of the activities in which the technology is embedded and used. That knowledge is used to interpret the data but is *not contained within the data*. Consequently where the evaluation of the functional value of collaborative systems is concerned there remains a continuing need to exercise caution.

Bibliography

The bibliography below was compiled by Dave Randall, is inevitably idiosyncratic, is not intended to be exhaustive and is certainly, out of date – its on our 'to do'list. It simply represents material we have found useful over many years when delivering versions of this tutorial. A few references appear twice, under different headings. Where appropriate, we have included brief annotations.[17]

Fieldwork:

Ackroyd, S. and Hughes, J.A., 1992, *Data Collection in Context,,* 2nd ed. London, Longmans.
A review of some of the main methods, and their rationales, of sociological investigation which places ethnography in this wider context.

Adams, R.N. and Preiss, J.J. (eds), 1960, "*Human Organization Research: Field Relations and Techniques.*", Homewood, Ill.: Dorsey Press.
A useful text, although a little dated, which brings together some classic articles difficult to access elsewhere, including Wax on 'reciprocity' and Richardson's work on the reporting of field relationships.

Anderson, J.M., 1988, 'The integration of HCI principles in structured system design methods', in Conference Proceedings MIlcomp '88, Military Computers, Graphics, and Software, 27-29 Sept, London

Anderson, R. J., (1994), 'Representations and Requirements: The Value of Ethnography in System Design.' Human-Computer Interaction, Vol. 9 pp. 151-182.
An important paper, insofar as it stresses that ethnographic enquiry cannot achieve what system designers might want from it. Rather it is concerned with the 'play of possibilities' for desig and is thus a corrective to some of the more 'hyped' versions of ethnography.
Bentley, R., Hughes, J., Randall, D., Rodden, T., Sawyer, P., Shapiro, D. and Sommerville, I., (1992), Ethnographically informed systems design for air traffic control, in Proceedings of CSCW'92, ed. J. Turner and R. Kraut, 123-129, Oct. 31-Nov 4, Toronto, Canada: ACM Press.
Gives a computer science view of the value (or otherwise) of ethnographic enquiry

Blythin, S, Rouncefield, M, Hughes, J (1997) Never mind the ethno' stuff, what does all this mean and what do we do now: ethnography in the commercial world, Interactions 4, 3 (May, 1997), pp 38-47, ACM Press

Interesting for its examination of real world relationships in an ethnographic study of banking.

Filstead, W.J. (ed), 1970, "Qualitative Methodology: Firsthand Involvement with the Social World." Chicage, Ill.: Markham.
This account draws on a wide range of illustrative material, including sections on roles in fieldwork, collecting data, validating, ethics, and methodological problems. A useful if not very coherent resource.

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[17] Portions of this bibliography where drawn from electronic archives, including Saul Greenberg's Annotated Bibliography at the University of Calgary and the HCI Bibliography Project archive at the Ohio State University.

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A collection of ethnographic studies, giving a first hand account of occupational, professional and organizational research.

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Heath, C., Luff, P. (1991). 'Collaborative activity and technological design: task coordination in London Underground control rooms'. In: L. Bannon, M. Robinson, K. Schmidt, (Eds.). *Proceedings of the Second European Conference on Computer Supported Cooperative Work*. Dordrecht: Kluwer: pp. 65-80
An early ethnographic study. It emphasises the role of 'at a glance' solutions to the practical problem of coordinating work in the London Underground.

Harvey, L. and Myers, M.D. "Scholarship and practice: the contribution of ethnographic research methods to bridging the gap", Information Technology & People, (8:3), 1995, pp. 13-27.
This article provides an overview of ethnography in IS research.

Hammersley, M. and Atkinson, P., 1983, Ethnography: Principles in Practice, London, Tavistock
Both the above are essentially sociological views of the functions and limitations of ethnographic work.. Arguably somewhat 'overengineered', but furnish a view of the issues involved in relating fieldwork and theory. References a wide range of sociological studies.

Hepso, V., 1997, The Social Construction and Visualisation of a New Norwegian Offshore Installation, in Hughes et al, proceedings of ESCW '97
An explicit and 'real world' attempt to do development work which integrates 'process' and 'situated' work.
Jordan, B. and Henderson, A., 1995, Interaction Analysis: Foundations and Practice, The Journal of the Learning Sciences, 4 (1)
Examines the use of video, in particular, and presents a very thorough account of the problems and affordances of video analysis. Highly recommended for anyone who proposes to embark on a video-based study.

Hughes, J., Randall, D., Shapiro, D. (1992) Faltering from Ethnography to Design. *Proceedings of ACM CSCW'92 Conference on Computer-Supported Cooperative Work*, pp.115-122 © Copyright 1992 Association for Computing Machinery.
An early version of the issues surrounding 'doing ethnography' for design purposes. Stresses the practicalities of the relationship between social scientists and designers. Uses Air Traffic Control as an examplar. Should be read in conjunction with Bentley et al, 1992
Randall, D., Hughes, J. A., and Shapiro, D. (1992) "Using Ethnography to Inform Systems Design". Journal of Intelligent Systems, Vol. 4, Nos 1-2.
A similar paper to the one immediately above.
Hughes, J., King, V., Rodden, T., Andersen, H. (1994). Moving out of the control room: ethnography in system design. In Proceedings of the Conference on Computer-Supported Cooperative Work (CSCW'94), Chapel Hill, ACM Press, pp. 429-438.
Suggests four different roles for ethnography. An influential paper, largely because of its characterisation of 'quick and dirty' ethnography.
Hughes J, O'Brien J, Rodden T, Rouncefield M, Blythin S (1997) 'Designing with ethnography a presentation framework for design'; Proceedings of the ACM conference on Designing interactive systems: processes, practices, methods, and techniques , 1997, Pages 147 - 158
Another in a long list of papers which attempts to deal with the vexed issue of formalisation in design. It stops short of recommending procedures for developing requirements and instead advocates clear methods for making ethnographic results interpretable by other interests.
Harper, R., 1998, Inside the IMF: An Ethnography of Documents, technology and Organisational Action, London, Academic Press

Heath, C. and Luff, P., 1996, Documents and professional practice: "Bad" Organizationbal Reasons for "Good" Clinical records, Proceedings of CSCW '96, Boston, Mass., M. Ackerman (ed.), new York, ACM Press

Junker, B., 1960, *Field Work*. Chicago, Ill.: University of Chicago Press.
A text based on the author's own experiences of the teaching and practice of ethnography and it techniques and includes interesting extracts from field work investigations.

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An edited collection with Computer Suppoorted Collaborative Learning as its topic. Mainly interesting because CSCL has begun to take notions such as the 'learning organisation' seriously

Kraemer, K. L. and Pinsonneault, A., 1990, Technology and groups: Assessments of the empirical research., In *Intellectual Teamwork: Social Foundations of Cooperative Work*, p373-404, J. Galegher, R. E. Kraut and C. Egido ed., Hillsdale, New Jersey, Lawrence Erlbaum Associates.
The paper provides an up-to-date portrait of the state of our knowledge about group decision support systems (GDSS). Five major research implications are offered: the lack of research on some important "formal" factors of groups; the lack of knowledge of the impact of GDSS on the informal dimensions of a group; the need to move away from the lab towards real field studies; the relation between group development and how it affects GDSS; and how the structure imposed by technology affects group processes.

Lofland, L., 1976, Doing Social Life: The Qualitative Study of Human Interaction in Natural Settings. New York: Wiley.
Concentrates on interactional strategies as the focus of qualitative research, although the introduction is rather fragmented, the book does contain a section on 'reporting an inquiry' and gives extended examples from published sources.

Luff, P., Hindmarsh, J. and Heath, C. (eds), 2000, Workplace Studies: Recovering Work Practice and Informing System Desiqn, cambridge University Press
A useful recent collection. Rehearses a range of studies and tries to draw out implications for the design process. The collection is divided into two parts. Part I contains a number of detailed case studies that not only provide an insight into the issues central to Workplace Studies but also some of the problems involved in carrying out such research. Part II focuses on the interrelationship between Workplace Studies and the design of new technologies.

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Rittel, H. and Webber, M., 1973, Dilemnas in a general theory of planning, *Policy Sciences*, 4, pp 155-169
One of the first papers to point to the 'wicked problem' involved in any form of engineering- a 'wicked' problem being one which admits of a variety of solutions.

Rivett, 1983, A world in which nothing ever happens twice, Journal of the Operations Research Society, 34 (8) 677-683
Some similar arguments to those produced by Rittel and Webber

Sommerville I, Rodden T, Sawyer P, Twidale M, Bentley R. Incorporating Ethnographic Data into the Systems Requirement Process, Proceedings of RE 93: International Symposium on Requirements Engineering, Jan. 4-6, San Diego, IEEE Press: 165-174.

Suchman, L. A., 1987, Plans and Situated Actions: The Problem of Human-Computer Communication , Cambridge University Press, New York.
The seminal text on the relevance of ethnomethodological enquiry to CSCW related issues. Often cited, but less often carefully read, since Suchman's work has been misunderstood at various points. Our version of it would be that it explains how plans can only be understood themselves as outcomes of situated activity- as indexical to the situation, or shorthands for it, and thus can never fully encompass the situation. It is emphatically NOT a text which argues we need not understand plans.

Suchman, L., 1988, Designing with the User., *TOOIS*, **6**(2), p173-183. Review of Computers and Democracy: A Scandinavian Challenge, G. Bjerknes, P. Ehn, and M. Kyng, Eds. Gower Press, Brookfield, VT, 1987.

Suchman, L., 1994, Do categories have politics?, *The Journal of Computer Supported Cooperative Work*, Vol 2 (3), Kluwer, the Netherlands.
A very influential, and hotly debated, paper. Can be seen as an adjunct to much partcipative design work. Various commentaries subsequently provided in a later volume of the same journal

Suchman, L., Beeman, W., Pear, M., Trigg, R., Fox, B. and Smolensky, P., 1987, Social Science and System Design: Interdisciplinary Collaborations., In *Proceedings of ACM CHI+GI'87 Conference on Human Factors in Computing Systems and Graphics Interface*, p121-123.

Tang, J. C., 1991, "Findings from observational studies of collaborative work." *International Journal of Man Machine Studies*, **34**(2), p143-160, February. In the special edition on CSCW & Groupware. Republished in Greenberg, 1991.
The work activity of small groups of 3 to 4 people was videotaped and analysed in order to understand collaborative work and to guide the development of their listing, drawing, gesturing, and talking around a shared drawing surface. The result is a set of design implications for tools that support shared workspace activity

Twidale, M., Randall, D., and Bentley, R., 1994, Situated Evaluation for co-operative Systems, *Proceedings of CSCW '94*
Presents a useful review of some of the main debates over evaluation, and stresses the limitations of 'controlled' work. Argues, by implication, for a more open ended view of the evaluation process.

Wax, R.H. , 1971, *Doing Fieldwork: Warnings and Advice.* Chicago, Ill.: University of Chicago Press. An interesting historic insight of ethnographic method, including Wax's own research in several different contexts. A well presented and accessible book.

Myers, M.D. *Critical Ethnography in Information Systems,* in Information Systems and Qualitative Research, A.S. Lee, J. Liebenau and J.I. DeGross (eds.), Chapman and Hall, London, 1997, pp. 276-300.

Applies an anthropological conception of ethnography to information systems research. The paper has been extremely influential in IS research in Europe. It discusses the nature and applicability of one qualitative approach to information systems research, called critical ethnography. Critical ethnography, informed by critical hermeneutics, is one of many possible approaches to ethnographic research. A critical ethnographic study of the development of an information system in mental health is reviewed.

Myers, Michael D. 1999. "Investigating Information Systems with Ethnographic Research," Communication of the AIS, Vol. 2, Article 23, pp. 1-20.

Ethnographic research is one of the most in-depth research methods possible. Because the researcher is there for a reasonable amount of time - and sees what people are doing as well as what they say they are doing – an ethnographer obtains a deep understanding of the people, the organization, and the broader context within which they work. Ethnographic research is thus well suited to providing information systems researchers with rich insights into the human, social and organizational aspects of information systems. This article discusses the potential of ethnographic research for IS researchers,

and outlines the most important issues that need to be considered for those considering using this method.

Plowman, R, Rogers, Y and Ramage, M. What are Workplace Studies For? In *Proceedings of ESCSW'95* (Stockholm, September 1995), Dordrecht. Kluwer.

Another influential paper, at least within the CSCW community. It argues that several years of ethnograhic research for design have as yet failed to produce a clear conception of what it is that fieldwork is supposed to achieve. The authors avoid any specific recommendations.

Pycock, J., Bowers, J. (1996) Getting Others to Get It Right: An Ethnography of Design Work in the Fashion Industry. *Proceedings of ACM CSCW'96 Conference on Computer-Supported Cooperative Work 1996.* pp.219-228 © Copyright 1996 Association for Computing Machinery

Shapiro, D. The Limits of Ethnography: Combining Social Sciences for CSCW. In *Proceedings of CSCW'94* (Chapel Hill NC, 1994), ACM Press, 417-428.

Suchman, L. (1995). Making Work Visible. Special issue of CACM, Vol. 38(9), pp. 56-64.

Watts, J., Woods, D., Corban, J., Patterson, E., Kerr, R., and LaDessa, C. Hicks, Voice Loops as Cooperative Aids in Space Shuttle Mission Control, in Proceedings of CSCW '96, Boston, Mass., M. Ackerman (ed.), new York, ACM Press
A nice evaluative study of the 'how it works' kind. Describes a relatively 'low-tech solution to communication problems and explains its functionality.

Lessons for the Interface
Bodker, S., Ehn, P., Knudsen, J., Kyng, M. and Madsen, K.,1988, "Computer support for cooperative design (invited paper)." In *Proceedings of the Conference on Computer-Supported Cooperative Work (CSCW '88)*, p377-394, Portland, Oregon, September 26-28, ACM Press.
The authors outline their theoretical perspective on design as cooperative work, and exemplifies the approach with reflections from the Aplex project. Historical roots of the Scandinavian approach to design are covered, and critical reflections made.
Bodker, S. and Gronbaek, K., 1991, "Cooperative prototyping: Users and designers in mutual activity." *International Journal of Man Machine Studies*, **34**(3), p453-478, March. In the special edition on CSCW & Groupware. Republished in Greenberg, 1991.
Given an environment conducive to participatory design, how does one go about doing it? The authors describe one method called cooperative prototyping. These involve sessions where users experience the future use situation, and then participate with designers in modifying the prototypes when usage breakdowns required it. Their article is especially valuable as it provides a theoretical framework, a practical guide for managing cooperative prototyping sessions, and an example of how cooperative prototyping develops in a real situation.
Brooks, F. P., 1975, The Mythical Man Month, Addison Wesley
An often- cited and never bettered account of the practical problems of project management. Deceptively easy to read and worth looking at twice, since the main point- that project planning never can or does fully encompass what gets done- is easy to miss.
Brooks, F. P., 1987, No silver bullet: Essence and accidents of software engineering, *IEEE Computer*, 20 (4), pp 10-21
Again, an extremely influential piece. The idea that no model, plan, methodology can solve all the problems of design is often forgotten.
Boehm, B. W., *Software Engineering Economics*, Prentice-Hall, 1981
Burgess, R. (ed) (1982) *Field Research: A sourcebook and Field Manual.* London: Allen & Unwin.
Although not a practical manual, it is a useful collection of articles, which includes both British and American work, drawing on a variety of disciplines including sociology, anthropology and history.
Draper, S. W. and Norman, D. A. , 1985, Software Engineering for User Interfaces., SE-11(3), p252-258.
This paper argues that the discipline of software engineering can be extended in a natural way to deal with the issues raised by a systematic design of human machine interfaces. The authors argue that because the principles of good user-interface design are not well understood that interfaces should be developed in an interative manner. The paper is interesting both as a historical account of hci interface development and as an indication of how ethnography may relate to systems development.
Salvendy, G. (ed), 1987, The Handbook of Human Factors, NY/Chichester, John Wiley
A classic text which provides an overview of the kind of work done in HCI

Grudin, J. 1988, Why CSCW Applications Fail: Problems in the Design and Evaluation of Organizational Interfaces. In *Proceedings of ACM CSCW'88 Conference on Computer-Supported Cooperative Work*, ACM press.
A seminal piece of work. Written at a time when there were no successful CSCW applications, it laid down a number of reasons and provided early guidelines for how research might be conducted.
Grudin, J., 1990, The Computer Reaches Out: The Historical Continuity of Interface Design., In *Proceedings of ACM CHI'90 Conference on Human Factors in Computing Systems*, p261-268.
There is a continuity to the outward movement of the computer's interface to its external environment, from hardware to software to increasingly higher-level cognitive capabilities and finally to social processes. As the focus shifts, the approaches to design and the skills required of practitioners changes. In this paper five foci or levels of development are identified. Most development today is positioned in the third level and considerable research is directed at the fourth. Some attention is now being given to the fifth: repositioning the interface in the work group or organization itself. Work at the different levels is not entirely independent, so establishing a comprehensive framework may enable us to position existing research and development efforts and plan future work more effectively.

Grudin, J. , 1991, CSCW: The convergence of two disciplines., In *ACM SIGCHI Conference on Human Factors in Computing Systems*, p91-98, New Orleans, April 28-May 2, ACM Press.
This essay provides an excellent discussion/review of the CSCW field, its early roots and derivations, what it is and isn't, and how it is perceived by today's community. In particular, CSCW is discussed as the convergence of two development disciplines, one concerned with small-groups, and the other with large systems. It provides a much-needed perspective on the CSCW "paradigm".

Hartson, H. R. and Smith, E. C., 1991, Rapid Prototyping in Human-Computer Interface Development., *Interacting with Computers*, **3**(1), p51-91.
Some conventional approaches to interactive system development tend to force commitment to design detail without a means for visualizing the result until it is too late to make significant changes. Rapid prototyping and iterative system refinement, especially for the human interface, allow early observation of system behaviour and opportunities for refinement in response to user feedback. The role of rapid prototyping for evaluation of interface designs is set in the system development life-cycle. Advantages and pitfalls are weighed, and detailed examples are used to show the application of rapid prototyping in a real development project. Kinds of prototypes are classified according to how they can be used in the development process, and system development issues are presented. The future of rapid prototyping depends on solutions to technical problems that presently limit effectiveness of the technique in the context of present day software development environments.

Heninger, K. L., 1980, Specifying software requirements for complex systems. New techniques and their applications, *IEEE Trans. Software Eng.*, SE-6 (1), pp 2-13
Brown, J. S. and Newman, S. E. (1985) "Issues in Cognitive and Social Ergonomics: From Our House to Bauhaus." *Human-Computer Interaction*, **1**(4), p359-391.
Intelligibility is one of the key factors affecting the acceptance and effective use of information systems. In this article, the discuss the ways in which recognition of this factor challenges current system design strategies, as well as current theoretical perspectives and research methodologies. In particular, they claim that in order to understand the problem of system intelligibility, we must focus on not only the cognitive, but also on the social aspects of system use. The authors elaborate on the relationship between information systems and the larger social environment, suggesting that the functionality and design of information systems can deeply influence the surrounding culture. They propose adopting a goal of socially proactive design and discuss the possibilities for embedding new paradigms for communication and problem solving in specialized information systems.
Markus and Connolly, 1990, Why CSCW Applications Fail: Problems in the Adoption of Interdependent Work Tools. In *Proceedings of ACM CSCW'90 Conference on Computer-Supported Cooperative Work*, ACM press.
McCall, G.J. and Simmons, J.L. (eds), 1969, *Issues in Participant Observation: A Text and Reader*. Reading, Mass.: Addison-Wesley.
A standard text although somewhat dated. A classic selection of readings including topics field relations, data collection, retrieval and recording, publishing, comparitive methods. It is in the main, a discussion of methodological issues rather than a practical field work manual, and the author shows a tendency towards positivism.

Types of Analysis:

Ethnomethodology.

A number of CSCW- related ethnomethodological studies have been published, and they include for brief mention:
Button, G. and Sharrock, W., 1997, The Production of Order and the Order of Production, in J. Hughes et al (eds.), Proceedings of ECSCW '97, Dordrecht, Kluwer
A nice study of operations in a publishing firm.
Harper, R., 1998, Inside the IMF: An Ethnography of Documents, technology and Organizational Action, London, Academic Press
One of the most fully- fledged ethnographic accounts of technology and organization available. Uses the interesting metaphor of document 'career' as a linking device.
Rouncefield, M., Hughes, J., Rodden, T. And Viller, S., 1994, Working with 'Constant Interruption': CSCW and the Small Office, in R. Futura and C. Neuwirth (eds.), Proceedings of CSCW '94, new York, ACM Press
Indicates something of the difference between ethnomethodological and 'idealised' accounts of procedure by showing how 'interruption' is a practical feature of work, seldom taken into account when models of process are developed.
Hughes, J., Randall, D. and Shapiro, D., 1992, Faltering from Ethnography to Design, in J. Turner and R. Kraut (eds.), Proceedings of CSCW '92, New York, ACM Press
An early version of the issues surrounding 'doing ethnography' for design purposes. Stresses the practicalities of the relationship between social scientists and designers. Uses Air Traffic Control as an examplar. Should be read in conjunction with Bentley et al, 1992
Drew, P and Heritage, J., 1993, Talk at Work, Cambridge University Press

An editied collection which takes a more or less conversation analytic view of institutional settings. Can be seen as part of the 'institutional talk' programme, and as such is controversial within ethnomethodology. Nevertheless, contains some interesting papers.
For those interested in ethnomethodology itself, the canonical resources are
Garfinkel, H., 1967, Studies in Ethnomethodology, London, Polity Press
The founding text in ethnomethodology. A very difficult read for the uninitiated
Garfinkel, H., 2002, Ethnomethodology's Program, Rowman and Littlefield
Some new work, and some less so. Garfinkel's review of ethnomethodology's progress over the last forty years.
any of Harvey Sacks' lectures. Recently published in collected form, edited by Gail Jefferson.
Button, G. (ed.), 1991, Ethnomethodology and the Human Sciences, Cambridge, Cambridge University Press
An edited collection of essays- the best of its kind in our view. Readers searching for CSCW related issues will be disappointed, but a clear statement of many ethnomethodological themes and in particular the roots of many disputes and misunderstandings with sociology-at-large.
Heritage, J., 1984, Garfinkel and Ethnomethodology, London, Polity Press
A textbook for those who find Garfinkel a struggle. Reasonably clear, but presents a version of ethnomethodology by no means shared by other practitioners.

Conversation Analysis

Lehnert and Ringle, 1982, Conversation and Discourse, in W. Lehnert and M. Ringle, Strategies for Natural Language Processing.
Button, G., Coulter, J., Lee, J., Sharrock, W., 1996, Computers, Minds and Conduct, London, Polity press.
Not Conversation Analytic, but a useful corrective to much of the hype about CA's value in the understanding of machine 'intelligence'
Wooffit, R., 1993, Analysing Information Exchange, Routledge
Argues that conversation analysis has important lessons for our understanding of human-machine communication and especially speech recognition systems. The book provides detailed and comparative studies of human and human-computer speech dialogues, including analyses of opening and closing sequences and turn-taking. It should be stressed that its conclusions remain extremely controversial, and for a powerful rebuttal, see Button, G., 'Going up a Blind Alley'

Gray, S, 1993, Hypertext and the Technology of Conversation, Greenwood Press

This book tries to relate conversation analytic themes to the specifics of troubles with Hypertext.

Heath, C. and Luff, P., 1990, Computers and Conversation, Academic Press
An edited collection of papers on conversation analysis. The theme is the relationship between CA and HCI/CSCW and the potential of this relationship for interactive system design. Includes some now classic papers.
Frohlich, D. M. and Luff, P. (1989), Conversational Resources for Situated Action, In *Proceedings of ACM CHI'89 Conference on Human Factors in Computing Systems*, p253-258.
This paper draws on Suchmans insights on 'situatedness' and its implications for the design of interactive computer systems. It contrasts assumptions about the globally managed human computer dialogue with a scheme for the local management of dialogues based on the findings of conversation analysis. The scheme makes available a variety of communicative resources to both user and system, including the ability to give and take turns at talk, to initiate and carry out repair work, and to continue or change the topic of conversation. An implementation of the scheme in a welfare rights Advice System is described.
Whalen, J. and Vinkhuyzen, E., 1999, Expert Systems in (Inter)Action: Diagnosing Document machine Problems Over the telephone, in Workplace Studies: Recovering Work Practice and Informing Systems Design, C.Heath, J. Hindmarsh and P. Luff (eds.), Cambridge University Press
A Conversation Analytic analysis of 911 emergency calls, and shows how the problem of dealing with emergencies is often the problem of working out what kind of problem exists.
Whalen, J., 1995, Expert systems versus Systems for Experts: Computer aided dispatch as a support system in real world environments, in P'Thomas, ed., The Social and Interactional Dimensions of Human-Computer Interfaces, Cambridge, Cambridge University press
Discusses some of the ways in which expert systems can fail to encapsulate the knowledge of experts.

Distributed Cognition

Hutchins, E., 1995, Cognition in the Wild, Boston, Mass., MIT Press
Middleton, D. And Engestrom, Y, 1995, Cognition and Communication at Work, London, Cambridge University Press.
Rogers, Y., Integrating CSCW in Evolving Organizations, in Proceedings of CSCW '94, pp 67-78, New York, ACM Press

Soft Systems Analysis

D.Patching, Practical Soft Systems Analysis, 1990, Pitman Publishing.
Provides an analysis of Soft Systems for Information Systems design.
P. Checkland and J. Scholes, 1989, Soft Systems Methodology in Action, Wiley.
P.Rivett, A world in which nothing ever happens twice, Journal of the Operations Research Society, 34 (8) 677-683
Checkland,P. , 1981, Systems Thinking, Systems Practice, Wiley.
An early version of Soft Systems theory, worth looking at for its fairly complete statement of the relevance of systems theory and the shortcomings of the 'hard' version.

Grounded Theory.

Fitzpatrick, G, Kaplan, S. And Mansfield, T., 1996, Physical spaces, Virtual Places and Social Worlds: A study of work in the Virtual, in M. Ackermann (ed.), Proceedings of CSCW '96, Cambridge, Mass., ACM Press.

Glaser, B.G. and Strauss, A.L., 1967, The Discovery of Grounded Theory, Chicago, Aldine.
A classic sociological text. Emphasises the gap between scientific study and standards of plausibility in sociology. Re-positions sociological theory according to its relationship with data.
Grinter, R.E., 1997, Doing Software Development: occasions for Automation and Formalisation, Proceedings of ECSCW '97, Lancaster, eds. J.Hughes, W. Prinz, T. Rodden and K. Schmidt, Kluwer

An excellent, and recent, study. Basically, an evaluation of the factors affecting the introduction of 'workflow' technologies for development work.

Activity Theory

Vygotsky, L., 1982, Collected Papers, Vol 1
To be read as background only, or for those determined to understand activity theory's auspices and relationship with other psychological positions.

Bardram, J, 1997, Plans as Situated Action: An Activity Theory Approach to Workflow Systems, in J. Hughes et al, proceedings of the 5th European Conference on CSCW, Dordrecht, Kluwer
One version of the 'plans and situated actions' debate, and uses activity theory to make sense of it.

Bodker, S. (1989) "A Human Activity Approach to User Interfaces." *Human-Computer Interaction*, **4**(3), p171-195.
Presents a framework for the design of user interfaces that originates from the work situations in which computer-based artifacts are used: The framework deals with the role of the user interface in purposeful human work. Human activity theory is used in this analysis. The main conclusion are: The user interface cannot be seen independently of the use activity, (i.e., the professional, socially organized practice of the users and the material conditions for the activity, including the object of the activity). The article argues that the user interface fully reveals itself to us only when in use. What is a good user interface for those with a certain degree of competence may not be efficient for those with different levels of competence.

Kuuti, K., 1994, Information Systems, Cooperative Work and Active Subjects: The Activity-Theoretical Perspective, Research Papers Series A23, ISSN 0786-8413, University of Oulu Printing Centre

Participative design.

Bansler, J., 1989, System Development in Scandinavia: Three theoretical schools, Scandinavian Journal of Information Systems, Vol 1.
Outlines the different paradigms associated with Information Systems research and is often used as a baseline account by proponents of the Scandinavian perspective.

Bermann, T. and Thorenson, K. (1988) "Can networks make an organization?" In *Proceedings of the Conference on Computer-Supported Cooperative Work (CSCW '88)*, p153-166, Portland, Oregon, September 26-28, ACM Press.
The authors share their experience of a cooperative systems development project involving centralization of several previously independent surgical departments in a hospital. A few simple cases illustrate that the conventional development process is wrought with conflicts, contradictions and challenges. In particular, the design of a cooperative system can neither be pushed by technology, nor by the workers view of what they require. Rather, the process is collaborative, where both designer and end user forward and evaluate ideas during system development. The work is an example of the "Scandinavian approach" to design.

Bjerknes, G., Ehn, P., and Kyng, M., (eds.), 1987, Computers and Democracy: a Scandinavian Challenge, Brookfield, VT, Gower Press

Bjerknes, G. and Bratteteig, t. 1987, Florence in Wonderland, in Bjerknes et al, Computers and Democracy: a Scandinavian Challenge

Bjerknes, G. and Bratteteig, T. (1988) "The memoirs of two survivors: Or the evaluation of a computer system for cooperative work." In *Proceedings of the Conference on Computer-Supported Cooperative Work (CSCW '88)*, p167-177, Portland, Oregon, September 26-28, ACM Press.
The authors describe their experiences with the "ultimate test" of a CSCW system built according to the Scandinavian approach by evaluating its use several months after installation. Through a series of flashbacks of diary clips and analysis, they bring us through the design process, giving the reader insight as to what happened and why things were designed a certain way. The result of their ultimate test did more than show a system in active use, for it described several surprising work habits that had developed.

Blomberg, J. L. and Henderson, A. (1990) "Reflections on Participatory Design: Lessons from the Trillium Experience." In *Proceedings of ACM CHI'90 Conference on Human Factors in Computing Systems*, p353-359.
In recent years system engineers, product designers, and human interface designers have become increasingly interested in developing ways of involving users in the design and evolution of computer-based systems. Some have turned for guidance and inspiration to an approach to systems design pioneered in Scandinavia and often referred to as Participatory Design. In this paper the development of a computer-based design tool, Trillium, which on the surface looked like an example of Participatory Design in that users were directly involved in the development of the technology, is examined. The analysis leads them to conclude that Trillium's development departed in critical ways from the current model of Participatory Design and to suggest that the manner in which users are involved in the development effort plays an important role in the success of the endeavor.

Bødker S. and Grønbæk, K., Cooperative prototyping: users and designers in mutual activity, in *International Journal of Man-Machine Studies*, 34, 1991, pp 453-478

Ehn, P., 1988, Work-oriented Design of Computer Artifacts, Arbetslivscentrum, Stockholm, 1988

Ehn, P., 1993, Scandinavian Design; On participation and skill, in D. Schuler and A. Namioka (eds), Participatory Design- Principles and Practice, Erlbaum, Hillsdale, N.J.

Greenbaum, J., 1988, In search of cooperation: An historical analysis of work organization and management strategies, In *Proceedings of the Conference on Computer-Supported Cooperative Work (CSCW '88)*, p102-114, Portland, Oregon, September 26-28, ACM Press.
Greenbaum offers a historical perspective of work organization and management strategies. In essence, she argues that the Scandinavian view of user participation in the design process is part of building democracy in the workplace. She indicates two central issues in the move to workplace democracy. First, democracy needs to be viewed as active participation in planning and decision-making, thus making worker involvement far more than techniques for improved human-computer interfaces. Second, CSCW means that computer systems need to reinforce forms of cooperation that enhance the chance for a more democratic workplace. For example, information flow in a CSCW application could emphasize lateral movement, as opposed to the top-down flow through authority normally seen in management. Planning functions could then move from current rule-based bureaucratic realms to situations where groups assume the stronger

Greenbaum, J & Kyng, M. (eds) (1991) *'Design at Work: Cooperative Design of Computer Systems'* Hillsdale. Lawrence Erlbaum.

Hales, M., 1993, User Participation in Design- What it can deliver, what it can't and what this means for management, in P. Quintas, Social Dimensions of Systems Engineering

Johnson, J., Ehn, P., Grudin, J., Nardi, B., Thoresen, K. and Suchman, L. (1990) "Participatory Design of Computer Systems." In *Proceedings of ACM CHI'90 Conference on Human Factors in Computing Systems*, p141-144.

Nielson, J.F. and Relsted, N.J., 1993, The New Agenda for User Participation: Reconsidering the old Scandinavian Perspective, Proceedings of the 16th IRIS, Copenhagen

Mumford, E., 1983, Designing Human Systems, Manchester Business School.
The originator of, and still very influential in, the socio-technical systems version of P.D.

Greenbaum, J. and Kyng, M., 1991, Design at Work, Lawrence Erlbaum Ass., Hillsdale, N.J.

Simonsen, J. and Kensing, F., 1994, in PDC '94: Proceedings of the Participatory Design Conference, ACM Press
One of a series of papers recounting the use of P.D. along with observational stances in a study of a radio station. A very interesting paper.

Computer Supported Cooperative Work: the Journal of Collaborative Computing, 2000, Vol 7, No3-4, Kluwer
A special edition on participative design. Contains a useful introductory article by Kensing and Blomberg., *which reviews the 'state of play'.*

Business Process Reengineering.

Davenport, T. and Short, J. E., 1990, The new Industrial Engineering: Information Technology and business process redesign, Sloan Management Review, Summer, Boston, Mass., Harvard Business School Press .
Makes a relevant point about new technology, which concerns its 'fit' with the business process. An attack from another angle on the 'black box' conception of technology.
Hammer, M., 1990, Re-engineering work: Don't automate, obliterate, Harvard Business Review, July/August
Hammer, A. and Champy, Re-engineering the Corporation,
A polemic, but gives some indication of the claims made for BPR
Harrington, H. J., 1991, Business Process Improvement, McGraw- Hill, New York

More substantial than the above, and interesting a. Because of its more cautious understanding of 'process' and b. For some of its methodological concerns.

Jacobson, I., Ericcson, M., and Jacobson, A., 1994, The Object Advantage: Business process Re-engineering with object technology, Addison- Wesley, Wokingham, England
Relates Object Oriented Programming to BPR. Requires some coding knowledge to understand, apart from a few more general chapters.

Randall, D., Hughes, J. and Rouncefield, M., 1995, Chalk and Cheese: BPR and Ethnomethodologically Informed Ethnography, Proceedings of ECSCW '95, Stockholm, Sweden
Contrasts the analytic work done under the auspices of the BPR 'Process Walkthrough' and ethnographic study, and makes the point that method resides in the analysis rather than the 'hanging around'.

O'Brien, B., 1992, Demands and Decisions, Englewood Cliffs, Prentice-Hall

Orlikoski, W., 1992, LEARNING FROM NOTES: Organizational issues in Groupware Implementation, Proceedings of ACM '92 Conference on Computer Supported Cooperative Work, Toronto
A classic of its kind. One of the first papers to make explicit the organizational factors that affect technological implementation.

Peppard, J. (ed.), 1993, IT Strategy for Business, Pitman, Guildford
Bog- standard textbook on I.T. and business, but gives a flavour of the downward pressure on design, much like O 'Brien above

Domains:

Financial Services:

Bowers, J. & Martin, D. (2000) Machinery in the new factories : talk and technology in a banks call center. *Proceedings of CSCW 2000.* PP 49-58 © 2000 ACM

Burton, D. (1994) Financial Services and the Consumer, Routledge, London

Channon, D. (1998) 'The strategic impact of IT on the retail financial services industry' Journal of Strategic Information Systems, 7, (1998) 183-197.

Fincham, R., Fleck, J., Proctor, R., Scarborough, H., Tierney, M., and Williams, R. (1994), Expertise and Innovation: Information Technology Strategies in the Financial Services Sector, Oxford, Clarendon Press.

Harper, R, Randall, D. & Rouncefield, M. (2000) Organizational Change in Retail Finance : An Ethnographic Perspective (Routledge Studies in Money and Banking), (Routledge, London & New York), Library Binding - 200 pages (February 2000) ISBN: 0415202647

Knights, D. (1997) Governmentality and Financial Services: Welfare Crises and the Financially Self-Disciplined Subject, in G. Morgan and D. Knights. (1997) Regulation and Deregulation in European Financial Services. Basingstoke, Macmillan

Smith, S and Wield, D. (1988) "New Technology and bank Work: Banking on IT as an Organizational Technology." In Harris, L., Coakley, J., Croasdale, M., and Evans, T. (1988) New Perspectives on the Financial System. London. Croom Helm.

Medical Work:

Berg, M. (1997); Rationalising Medical Work: Decision Support Techniques and Medical Practices. Cambridge: MIT Press

Doherty, N. F., King, M. and Marples, C. G., 'The Impact of the Hospital Information Support Systems Initiative on the operation and Performance of Acute Hospitals', in Proceedings of the 4th UKAIS Conference, York, pp645-655, 7-9 April 1999.

Fitzpatrick, G., Understanding the Paper Health Record in Practice: implications for EHRs, in Proceedings of IC'2000.

Print Industry

Button, G. and Sharrock, W., 1997, The Production of Order and the Order of Production, in J. Hughes et al (eds.), Proceedings of ECSCW '97, Dordrecht, Kluwer

A nice study of operations in a publishing firm.

Orr, J. (1996) Talking About Machines: An Ethnography of a Modern Job. Ithaca, NY, ILR Press.

Features of Work:

Technology:

Button, G. (ed) (1993) Technology in Working Order: Studies of Work, Interaction and Technology. London. Routledge

Button, G., Dourish, P. (1996) Technomethodology: Paradoxes and Possibilities. *In Proceedings of ACM CHI 96 Conference on Human Factors in Computing Systems 1996*, v.1, pp.19-26 © Copyright 1996 ACM.

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