

Chapter 9

Ethnography and the social structure of work

David Martin and Ian Sommerville

Lancaster University

1 Introduction

Achieving dependable systems design and implementation is now considered to be a process where attention needs to be paid not only to the technical system but also to the social and work environment into which the system will be placed. Dependability is seen as a property of the whole socio-technical system. Socio-technical systems comprise, holistically, computer based systems and the social systems of work of the people that work with, through and around those computer based systems. It is acknowledged that particular consideration is required to understand how well the technical system will fit with the activities of the users in the proposed setting (the application domain). For instance, highly dependable technical systems may be part of an undependable socio-technical system because they are inappropriate to the setting and users. This chapter discusses the relationship between the social structure of work and the technical structure of a system and the importance of understanding that relationship when designing dependable socio-technical systems.

Ever since the 'turn to the social' in systems design [12], areas of computer science and systems design – most notably computer supported cooperative work (CSCW) and human-computer interaction (HCI) – have been increasingly interested in and have widely acknowledged that design may be enhanced by a better understanding of the social 'systems' of work into which computer systems will be imbedded. This is because researchers and professionals now understand that the functions and processes of any technical system need to mesh well with the work practices of personnel (or that the people or the system will be able to adapt such that they will mesh well) or problems will occur with the use of that technical system. This may range from

staff producing workarounds to fit the system to their work – meaning the system is being used non-optimally – to acts of sabotage or the rejection of the system. Concurrently (but not just coincidentally), this period has also seen the rise to prominence of ethnography (or observational field studies) as a key method for studying social systems of work – the interaction of personnel with each other, with computers and other artifacts, in their ‘home’ environment – the shop floor, the office, the control room, the home and so forth [2: [21]; 21].

A major strand of ethnographic work within the systems design area draws on the program of ethnomethodology ([9] see [18]; [7] for studies in computing). Ethnomethodology eschews theorising and instead takes an approach to field studies whereby ‘work’ is analysed and explicated in the terms in which it is organised as a recognisable social accomplishment by the participants in that setting, rather than describing it in relation to extrinsically generated theoretical constructs. Ethnomethodology is interested in explicating the *social structure of action*, as it is produced in a setting. It takes the position that activities are structured from *within* in response to developing situational contingencies and as such this means that every given occasion of e.g. a telephone banking call will have its own unique structure. Different calls will be structurally similar, and differences in calls will be accountable in terms of how they emerge in the particularities of an unfolding situation.

The job of the researcher following an ethnomethodological program is to explicate what these methods and practices are and how they are deployed in unfolding action, to note regularities (and exceptions) in action and to delineate the circumstances that provoke them. For example, they will describe the methods by which control room workers coordinate their work around various computer systems and paper artifacts to achieve an ordered airspace in air traffic control [14]; or, explicate the practices by which telephone operators in a bank call centre achieve smooth interaction with their computer system and customers [3]. Such studies have a definite sociological interest – how is this work actually done? However, they have also been “*surprisingly useful*” [30] for systems design as many involved in that field have realised that these studies can fill in the ‘just what actually goes on’, ‘just how is this actually done’ - the *haecceities*, or ‘just thisness’, (cf. [19]; [10]) – of action and interaction in a situation that are missing from purely technical, data centric representations of work.

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In this chapter, we consider ethnography and structure from a number of perspectives. We start by discussing how ethnomethodological ethnography can be used in practice to reveal the social structure of work. We go on to argue that the collected ethnographic data can itself be usefully structured and we suggest a structure that helps organise this data in such a way that it can support systems design. This structure has been carefully designed to help reveal the social structure of work. We then examine this notion and its relationship with the structure of supporting computer-based systems, and discuss how organisational structure imposed by rules, plans and

procedures influences and affects the social structure of work. Finally, we reflect on social structure and system dependability, making the point that the key requirement for socio-technical systems dependability is that there should not be a major mismatch between the structures assumed by that system and the practical social structure of work.

2 Ethnography

Ethnography is a method of data capture that works through the immersion of the researcher within the environment being studied, collecting detailed material (notes, documentation, recordings) on the ‘real-time real-world’ activities of those involved. Periods of immersion can range from intensive periods of a few days to weeks and months (more common in systems design studies), and even years. A primary product of most ethnographies is the development of a ‘rich’ description – a detailed narrative – of the work or activity in question, which may then be further *analysed* or *modelled* for various means, taking various approaches. The means may be for the purposes of answering sociological, psychological or systems design research questions, with the different approaches for analysis arising from various theoretical and methodological perspectives within these areas.

Ethnographers are interested in studying the work going on in settings rather than just computer systems in a narrow sense – they are interested in studying computer systems in operation, being used by people, within an organisational context and therefore shaped by organisational norms, rules, procedures, ethos, culture etc. In this conception we can think of, for example, a tax office as a complete organisational system – it comprises various technologies (e.g. computer and paper-based), organisational rules, processes (and methods for implementing them) and so forth, and staff who draw on their everyday and specialised social and vocational skills, abilities and knowledge to operate the technologies and work according to organisational requirements.

3 Structuring ethnographic data

Ethnographic records are collected opportunistically and, consequently, cannot be planned, organised and structured during the ethnography itself. However, when the raw data is analysed, we believe that it is useful to organise and structure this data in such a way that it is more accessible to system designers. We do this by providing a series of topics that can be used to guide observations and organise (or *structure*) fieldwork data. These topics have been developed in the ethnomethodological litera-

ture, particularly through the studies that have been presented for computing audiences (see, for example, [1; 4; 5; 16; 17]). The topics provide a comprehensive framework for considering features of social systems of work and how social systems interact with technical systems, rules, plans and procedures and the spatial arrangement (ecology) of the workplace.

We suggest eight different headings that may be used to structure and organise ethnographic data. However, we are not suggesting that these are the only ways to impose structure on this data or that the headings proposed are necessarily relevant to every study and setting. Rather, from extensive experience, we have found that these structural devices allow a mass of data to be organised so that it becomes more accessible to system designers who can relate the ethnographic structure to the structure of the requirements and the design of the computer-based system.

3.1 Temporality and sequentiality

3.2 The working division of labour.....

3.3 Rules, plans and procedures

3.4 Routines, rhythms, patterns

3.5 (Distributed) coordination

3.6 Awareness of work

3.7 Ecology and affordances

3.8 Skills, knowledge and reasoning in action

4 The Social Structure of Work

In the previous section, we introduced a set of headings under which we believe it is useful to organise the ethnographic record and, in some cases, they may be effective

in focusing ethnographic studies. These headings are not, of course, arbitrary, but reflect perspectives through which we believe it is possible to discern *the social structure of work*.

The social structure of work can be thought of as the way in which work is organised as a social process – how organisations perceive how work should be done by their employees and how this is reflected in actual practice by the people doing the work. Unlike a system architecture, say, it is a more subjective, dynamic concept and cannot reliably be expressed as a set of static models.

Broadly speaking we suggest that there are three relevant forms of structure which are central to the social structure of work:

Temporal and sequential structure: how processes and practices unfold – the relationships between entities, actions, utterances etc. over time in sequence.

Spatial structure: related to the spatial relationships between objects, persons, actions and so forth.

Conceptual structure: (sometimes also termed *ontological*, in a particular usage in computing) what a set of objects, entities, people, actions are, how they can be individuated and how they relate to one another conceptually¹.

Of course, these notions are also applicable to some extent to the structure of technical systems. The temporal and sequential structure reflects the assumptions of systems designers as to the sequences of operations that the system will support and the dependencies between the members of these sequences. The conceptual structure is, in essence, the system and data architecture and the abstractions used in the system design. The spatial structure is, perhaps, less significant because of the intangibility of software but may be reflected in some systems where the physical positioning of hardware is significant or in the layout and organisation of the system's user interface.

Ethnomethodological studies of work are often interested in the temporal and sequential structure of processes in the technical system (structured as a series of definite steps – '*workflow without*', cf. [2]) and how well these processes mesh with the ways in which the social practices are structured temporally and sequentially from within. Commonly, the temporal structures of the technical system are much more rigid than the fluid, reactive structures of the social system and this leads to a mismatch where users are frustrated by the restrictions imposed by the technical system.

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¹ Dourish states that questions of ontological or conceptual structure "...address(es) the question of how we can **individuate** the world, or distinguish between one entity and another; how we can understand the relationships between different entities or classes of entity; and so forth." ([8], p.129)

4.1 Rules, plans and procedures

We defined the social structure of work in the previous section as a reflection of both how work is perceived by an organisation and how that work is actually carried out by people. The organisational view is normally defined in sets of rules, plans and procedures. Rules define conditions that must be maintained (e.g. credits and debits must balance), plans (or processes) define workflows (e.g. what steps are followed to close an account) and procedures define the particular ways in which activities are carried out (e.g. how to validate a customer's identity).

Practical experience, as well as a wide range of ethnographic studies, tells us that the way in which work is actually done and the way in which it is set out in the rules, plans and procedures is often markedly different. Different people interpret the organisational rules, plans and procedures in different ways depending on their competence, knowledge, status, experience and the contingencies of each particular situation.

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5 Social structure and system dependability

How do we now approach the dependable design of socio-technical systems given this understanding of 'social structure' in socio-technical systems? The key issue here is to understand the way in which the structure of technical systems and the structure of rules, plans and procedures, fit with that of the social system. The relationship cannot be adequately described in formal structural terms, i.e. it is not possible to produce an accurate *model* of a socio-technical system because social practices are structured from within while technical systems are structured from without (they have a structure that can be specified separately to the technology they are implemented in).

Technical systems can be, and are, modelled, social practices are emergent, dynamic and are always responsive to the contingencies of *this situation, this time*. Models of social practices abstract, gloss and rationalise these features of them, giving them a rigid, formulaic structure not found 'in the wild'. Therefore, while models of social practices can be made *commensurate* with those of technical systems, i.e. by encapsulating a user model in the structure of the GUI, caution needs to be applied when considering how usable the system will be (how well it will fit in with social practices). The abstractions, glosses and rationalisations of practice used to construct the *idealised* user model may have problematic consequences when implemented in a real, dynamic and contingent situation. Social practices will have to adapt in a way that enables users to carry out what they need to do, in each case, in response to the idealised user model encapsulated in the system. The idealised user model will not

match what they already do, and it may well clash quite badly with certain crucial aspects of everyday practice.

Technical systems, however, need to be built using user models and models of work. Does this necessarily set up a serious problem? Fortunately the answer to this is no, for two reasons. Firstly, humans and the social systems they form are necessarily adaptive. They respond to the contingencies of *this* situation, *this* time, and they can also adapt their practices over time to work successfully with a computer system that initially fitted badly with their work practices. Secondly, user models can be created through observation 'in the wild' rather than theoretically conceptualised. A user model or model of work based on a faulty or incomplete understanding of work, or created through imagining what users do, rather than discovering what they do runs serious risks of misunderstanding the users or misrepresenting their work.

A key feature of system dependability concerns efficient and effective socio-technical system operation such that personnel will be able to achieve work with technical systems successfully. This includes the extent to which technical systems will not have to be worked around, and will not inhibit important social practices, or getting the job done. Achieving dependability also includes an assessment of how reliable, safe, secure, resistant to failure these processes and practices are. A design process therefore involves an assessment of current working, and is often characterised by a desire to transform things to make them better or more dependable. The desired design is envisaged to 'preserve' certain adaptive, or desirable, patterns of work, while transforming inefficient, maladaptive or inconsequential practices for organisational gains. Better decision making in this process should be facilitated by a detailed understanding of current process and practice.

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6 Conclusion

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References

- [1] Anderson R, Hughes J, Sharrock W (1989) Working for profit; The Social Organisation of Calculation in an Entrepreneurial Firm. Aldershot: Avebury
- [2] Bowers J, Button G, Sharrock W (1995) Workflow From Within and Without: Technology and Cooperative Work on the Print Industry Shopfloor. In Proceedings of ECSCW '95, Kluwer, Stockholm

- [3] Bowers J, Martin D (2000) Machinery in the New Factories: Talk and technology in a bank's call centre. In Proceedings of CSCW 2000, ACM Press, Philadelphia
- [4] 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, ACM, pp.19–26
- [5] Crabtree A, Nichols DM, O'Brien J, Rouncefield M, Twidale MB (2000) Ethnomethodologically-Informed Ethnography and Information System Design. In Journal of the American Society for Information Science, 51(7), pp.666–682.
- [6] Crabtree A, Hemmings T, Rodden T (2002) Pattern-based support for interactive design in domestic settings. Proceedings of the 2002 Symposium on Designing Interactive Systems. London: ACM Press.
- [7] Crabtree A (2003) Designing Collaborative Systems: A practical guide to ethnography. London: Springer-Verlag.
- [8] Dourish P (2001) Where the Action Is: The Foundations of Embodied Interaction. Cambridge: MIT Press.
- [9] Garfinkel H (1967) Studies in ethnomethodology. Englewood Cliffs, N.J.: Prentice-Hall.
- [10] Garfinkel H (2002) Ethnomethodology's Program: Working out Durkheim's Aphorism. Rowman & Littlefield, Oxford
- [11] Gibson JJ (1979) The ecological approach to visual perception. Boston, Houghton Mifflin
- [12] Grudin J (1990) The Computer Reaches Out: The Historical Continuity of Interface Design. In proceedings of ACM Conference on Human Factors in Computing Systems. CHI'90: Seattle, Wv.1, pp.19–26 © Copyright 1996 ACM.
- [13] Heath C, Luff P (1992) Collaboration and control: Crisis management and multimedia technology in London Underground line control rooms. Computer Supported Cooperative Work, 1, pp. 69–94
- [14] Hughes J, Randall D, Shapiro D (1992) Faltering from ethnography to design. Proceedings of ACM CSCW '92, Conference on Computer-Supported Cooperative Work, ACM, pp. 115–122
- [15] Hughes J, King V, Rodden T, Andersen H (1994) Moving Out from the Control Room: Ethnography in System Design. Proceedings of ACM CSCW '94, Conference on Computer-Supported Cooperative Work, ACM, pp. 429–439
- [16] Hughes J, O'Brien J, Rodden T, Rouncefield M, Blythin S (1997) Designing with Ethnography: A Presentation Framework for Design. Proceedings of DIS'97: Designing Interactive Systems: Processes, Practices, Methods, & Techniques 1997, ACM, pp. 147–158

- [17] Hughes J, O'Brien J, Rodden T, Rouncefield M (1997) *Ethnography, Communication and Support for Design*. CSEG Technical Report Ref: CSEG/24/1997
http://www.comp.lancs.ac.uk/computing/research/cseg/97_rep.html
- [18] Luff P, Hindmarsh J, Heath CC (eds.) (2000) *Workplace Studies: Recovering work practice and informing system design*. Cambridge: Cambridge University Press
- [19] Lynch M (1993) *Scientific Practice and Ordinary Action: Ethnomethodology and social studies of science*. Cambridge: CUP
- [20] Martin D, Bowers J, Wastell D (1997) *The Interactional Affordances of Technology: An Ethnography of Human-Computer Interaction in an Ambulance Control Centre*. Proceedings of the HCI'97 Conference on People and Computers XII 1997, pp. 263–281
- [21] Martin D, Rouncefield M (2003) *Making The Organisation Come Alive: Talking through and about the technology in remote banking*. In *Human-Computer Interaction*. Vol 17, No's 1 & 2. pp. 111–148
- [22] Martin D, Mariani J, Rouncefield M (2004) *Implementing an HIS project; Everyday features and practicalities of NHS project work*. *Health Informatics Journal*. Vol. 10 (4), Sage, London, pp. 303-313
- [23] Martin D, Rouncefield M, O'Neill J, Hartwood M, Randall D (2005) *Timing in the Art of Integration: 'That's how the Bastille Got Stormed'*. Paper Submitted to Group 05
- [24] Pettersson M, Randall D, Hegelson B (2002) *Ambiguities, Awareness and Economy: A Study of Emergency Services Work*. In *Proceedings of ACM CSCW 2002*
- [25] Pettersson M, Rouchy P (2002) *'We don't need the Ambulance then' – Technological Handling of the Unexpected*. Presented at the XV World Congress of Sociology, 7-13 July 2002, RC.25 Language, Technology and Work, Brisbane, Australia.
- [26] Reddy M, Dourish P (2002) *A Finger on the Pulse: Temporal Rhythms and Information Seeking in Medical Work*. Proceedings of the ACM Conference on Computer-Supported Cooperative Work CSCW 2002 (New Orleans, LO), New York: ACM, pp. 344–353
- [27] Schmidt K (1997) *Of Maps and Scripts: The status of formal constructs in cooperative work*. In *Proceedings of Group 97*, ACM Press
- [28] Sharrock W, Anderson R (1992) *Can organisations afford knowledge? Computer Supported Cooperative Work*, 1, pp. 143–162
- [29] Sommerville I, Rodden T, Sawyer P, Bentley R (1992) *Sociologists can be surprisingly useful in interactive systems design*. Proceedings of HCI 92, 341-353. Cambridge, UK: Cambridge University Press

- [30] Sommerville I, Rodden T, Sawyer P, Twidale M, Bentley R (1993) Incorporating Ethnographic Data into the Systems Design Process. In Proceedings of RE 93: International Symposium on Requirements Engineering, January 4-6, San Diego, IEEE Press: pp. 165–174.
- [31] Suchman LA (1987) Plans and situated actions: The problem of human-machine communications. Cambridge, UK: Cambridge University Press
- [32] Tolmie P, Pycocok, J, Diggins T, Maclean A, Karsenty A (2002) “Unremarkable computing”, Proc. of CHI 2002, Minneapolis: ACM Press, pp. 399-406
- [33] Viller S, Sommerville I (1999) Coherence: an Approach to Representing Ethnographic Analyses in Systems Design. Human-Computer Interaction 14: pp. 9–41
- [34] Whalen J, Vinkhuyzen E (2001) Expert Systems in (Inter)Action: Diagnosing Document Machine Problems over the Telephone. in Luff P, Hindmarsh J, Heath C (eds.) Workplace Studies: Recovering Work Practice and Information System Design, Cambridge University Press, Cambridge, UK, pp92–140.
- [35] Wittgenstein L (1958) Philosophical Investigations, Oxford, Blackwell