Despite the extraordinary advances in digital and communication technology over recent years, we know very little about the way these complex systems affect everyday work and interaction. This book seeks to explore these issues through a series of video-based field studies. It begins by discussing the introduction of basic information systems in general medical practice and ends with an exploration of interpersonal communication in advanced media spaces, in the process also looking at news production, the control room of London Underground and computer-aided design in architectural practice. Social interaction forms a particular focus of these studies as they explore the way individuals use various tools and technologies and co-ordinate their actions and activities with each other. The authors also show how video-based field studies of work and interaction can inform the design, development and deployment of new technology in this valuable new resource for academics, researchers and practitioners.

Technology in Action

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Christian Heath
King's College, London

Paul Luff
King's College, London

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Contents

Preface

> [The future of the telephone will mean] . . . nothing less than a reorganisation of society – a state of things in which every individual, however secluded, will have at call every other individual in the community, to the saving of no end of social and business complications, of needless goings to and fro, of disappointments, delays, and a countless host of great and little evils and annoyances which go so far under present conditions to make life laborious and unsatisfactory.
>
> Scientific American (1880: 16)

> That's a funny kind of thing, in which each new object becomes the occasion for seeing again what we see anywhere; seeing people's nastinesses or goodnesses and all the rest, when they do this initially technical job of talking over the phone. The technical apparatus is, then, being made at home with the rest of our world. And that's a thing that's routinely being done, and it's the source for the failures of technocratic dreams that if only we introduced some fantastic new communication machine the world will be transformed. Where what happens is that the object is made at home in the world that has whatever organisation it already has.
>
> Sacks (1972 (1992): 548)

Though each generation is startled by some innovation which they fear will change a familiar world, for many of us the digital revolution has indeed transformed our working lives. Over the past couple of decades our offices have become littered with equipment; technologies which it was believed would supersede our paper world and its accompanying paraphernalia. Whilst few of us have achieved, or would want to achieve, the inhuman order of the futuristic office, the computer has had a profound impact on the ways in which we work and how we work with others. Despite our reluctance, these technologies have been made at home in our world and have come to play an inevitable part in almost all the activities in which we engage. We are told that this is just the beginning. These bits and pieces of equipment are the crude precursors to a golden age of digital technology which will transform how we work, where we work and who we work with. Technology will lead some into a glorious future with the rest shuffling in the shadows behind.

The emergence of new technologies has been accompanied by a wealth of academic research in both the social and cognitive sciences. Despite the enormous contribution of this research to our understanding of such issues as the information society, human–computer interaction and the social construction of objects and artefacts, there remain relatively few studies concerned with how new technologies feature in our day-to-day working lives and our interaction with each other. This book is a small attempt to redress the balance. It forms part of a growing corpus of ethnographies concerned with technology and social action; research which is proving of relevance to not only contemporary debates within the social and cognitive sciences, but also more practical interests in the design and deployment of advanced systems.

This book consists of studies of different types of technology in a variety of organisational domains. It begins by discussing the introduction of a basic information system into general medical practice, and towards the end explores interpersonal communication in an advanced media space designed to support collaborative working. Between these two, seeming extremes, we examine news production at Reuters, command and control in London Underground and the Docklands Light Railway, and Computer-Aided Design (CAD) in an architectural practice. Each of these studies is based on extensive field work and video-recording of the day-to-day activities of the participants themselves. The studies draw on ethnomethodology and conversation analysis to examine the practices and reasoning on which participants rely to accomplish their actions and activities in the workplace and how technologies feature in the production and co-ordination of their everyday conduct. Social interaction – talk, visual and material conduct – forms a particular focus of many of these studies, as they address the ways in which participants collaborate in and through the tools and artefacts which are readily available to hand. The studies therefore are concerned with the seemingly 'fine details' of work and interaction, details that we hope to show are critical to a sociological understanding of both technology and organisational behaviour.

In the first chapter, we explore the rather curious provenance of these and related ethnographic studies of technology and work. We begin by pointing to the ways in which sociology has tended to disregard how these new tools and artefacts feature in social action and interaction and has left the field inadvertently dominated by cognitive psychology and, in particular, Human–Computer Interaction more commonly known as HCI. The conceptual and methodological basis to much of this research has been subject to sustained criticism in recent years, and in consequence there is a growing interest, both within cognitive science and in other disciplines, in the social and situated character of technology, thought and

action. These debates converge with developments in other fields such as Computer Supported Cooperative Work (CSCW) and requirements engineering, and together they have provided a springboard for the emergence of a body of naturalistic research from various disciplines concerned with how technologies feature in everyday organisational conduct and communication. These contemporary academic debates and developments have been enhanced by the growing recognition that technologies not only can fail, sometimes with tragic consequences, but in many cases, despite the good intentions of both designers and management, do not uphold their promise. For those who are less familiar with the sort of research discussed in the book, we have also included a brief note on our own approach, and in particular how we use video-recordings, augmented by field work, to examine the socially organised character of practical action and interaction in the workplace.

Chapter two is concerned with the introduction of information technology into medicine and in particular general practice. The original aims of the system were to provide a treatment database and to assist with the issuing of prescriptions. It was also expected that it would largely replace the traditional paper record that general practitioners had used since the foundation of the health service. Some years following the introduction of the system however, many general practitioners still rely upon the original paper medical record cards and use the two technologies alongside each other. We consider why this might be so. In particular, we examine the ways in which doctors assemble and use the medical record within the consultation, and how their seemingly idiosyncratic jottings and notes are designed with regard to the practicalities of their work, especially their everyday dealings with patients. Unfortunately the original system, despite the best of intentions, made small but significant changes to the ways in which data are stored and retrieved in the record, and in consequence undermined the doctor's ability to use the information within the day-to-day practicalities of consultative work.

Chapter three adopts a rather different standpoint; it considers how the use of a particular technology is co-ordinated with the concurrent actions and activities of others within the immediate domain. The setting is the editorial section of an international news agency which provides on-line news to financial institutions, newspapers, and radio and television stations. The journalists receive the stories, on-line, from agencies throughout the world. They have to check the stories, rewrite and edit them, and, where necessary, make sure the relevant customers receive the right news in the appropriate form. In some cases, the turn-around time for a story should be less than a minute. When working on stories, journalists remain sensitive to whether particular stories are relevant to other editorial desks,

and, if they believe they are, they have to pass the stories to colleagues, with dispatch. It is important, however, that journalists do not overwhelm their colleagues with information or interrupt the activities in which they are engaged. In the chapter, we discuss the ways in which they make stories visible to others within the domain, and invite, but not demand, that others pick up on particular items. In this way, the chapter is concerned with the collaborative production of news stories and how journalists shape their activities with regard to the interests and conduct of colleagues.

Parallel issues arise in the control rooms of London Underground. The control rooms include various staff who are responsible for dealing with the day-to-day problems and difficulties which inevitably arise in the operation of a major urban transport system. Within the rooms there is a relatively strict division of labour, with some staff responsible for signalling, others for delivering information to passengers and line controllers who have overall responsibility for dealing with problems. To help their work, the control rooms include an array of multimedia technologies, including closed-circuit television (CCTV), electromechanical diagrams, digital displays of traffic locations and service operation, and communication devices such as radios, touch-screen telephones and public address systems. In dealing with problems and crises, it is critical that staff maintain some compatible sense of what is happening and how it is being dealt with. Indeed, without this intelligence, the various information displays are almost useless. The difficulty is that in times of stress staff rarely have the time nor the inclination to tell each other what they are doing or what is happening. The chapter explores how individuals coordinate the actions and activities with each other in the line control rooms, and how various tools and technologies are used in managing problems, and in making sense of each other's conduct including the conduct of others outside the control room like station staff and drivers. Of particular importance are the ways in which personnel participate in each other's activities and how they remain sensitive to the conduct of others, even though they themselves are engaged in seemingly distinct and unrelated tasks.

Chapter five is also concerned with a control room of an urban transportation system, that of the Docklands Light Railway in the East of London. Although the personnel in the London Underground control room considered in chapter four and those in the Docklands Light Railway in this chapter have broadly similar responsibilities for command and control, a different configuration of technology has been deployed. This is principally because an automatic train supervision system (or ATS) allows trains to be operated without drivers. Despite the original

objectives behind the deployment of the technology, the system requires frequent intervention from the controllers. Chapter five focuses on the 'uses' of the ATS system, a fairly conventional command-and-control system, in the control room, and explores how the technology is immersed within the action and interaction of the participants. In particular, we explore how the entry of commands into the system by one controller is co-ordinated with the conduct of colleagues, and how their conduct is inextricably related to their colleague's use of the system.

The collaborative nature of activities surrounding the use of computer technologies is also the focus of chapter six. Here, we examine a domain that has been of interest to researchers and developers within both HCI and CSCW – design, or, more particularly, architectural design. In particular, we look at the uses within an architecture practice of a CAD system. We explore in detail not only how screen-based activities are accomplished, but how these seemingly individual actions on personal workstations can be related to those of other colleagues within the setting, particularly to accomplish collaborative activities. We examine, therefore, both the use of a graphical user interface, a concern for those in HCI, and an aspect of shared drawing, an area of interest for those in CSCW. Like previous chapters, the analysis points to the ways in which it becomes empirically difficult and conceptually problematic to clearly distinguish between the 'individual' and 'collaborative' use of the technologies.

Chapter seven considers the use of technologies rather distinct from those considered in the earlier chapters. We examine the use and development of innovative and prototype systems designed to support collaborative work amongst individuals who are located in distinct physical spaces. These systems, commonly known as 'media spaces', consist of audio-visual and computing infrastructures, which allow individuals in different locations to see and talk to each other, and in some cases to share documents and even see each other's local environment. The chapter discusses the introduction of these technologies and the ways in which individuals act and interact with and through the system. The analysis reveals how the technologies transform the very ways in which individuals are able to communicate with each other, and how resources and assumptions on which we ordinarily rely are rendered problematic by the technology. We then discuss how the findings of the research have been used to inform the development of further prototype systems, systems which attempted to address some of the difficulties with the technology, in particular, to provide more flexible and variable access between participants. We briefly discuss some of the results of these experiments and their consequences for the development of media spaces and other collaborative technologies.

In the final chapter, we briefly address an issue which has become of increasing importance to workplace studies over the past few years, namely, to what extent can they provide a foundation to the design and deployment of new technologies. For our own part, though many of the studies discussed in the book have been part of 'design projects', we believe that the importance of these and related ethnographic studies of work and technology, does not principally lie in their short-term contributions to particular systems. So, whilst the chapter illustrates how specific studies can inform design, and thereby perhaps form exemplars for future projects, we are more concerned with demonstrating how these and other workplace studies can provide a body of distinctive findings concerning the use of technologies in organisational environments. Aside from their empirical contributions, these observations and findings are forming the foundation to a reconsideration and respecification of many of the key concepts and findings which have hitherto underpinned both research and design in areas such as HCI and CSCW. The empirical and conceptual implications of these naturalistic studies of work, interaction and technology are also, we believe, of relevance to contemporary research in various other fields including the sociology of work, organisational behaviour and studies of language use and interaction. In a small way, therefore, we hope to demonstrate that, by placing technology in action at the heart of the analytic agenda, we have the opportunity to further develop an understanding of social interaction and work which is of both academic and practical relevance.

The research discussed here was originally begun at the Xerox Research Centre in Cambridge (formerly known as EuroPARC). Bob Anderson and Tom Moran, Lucy Suchman, Austin Henderson, Gitty Jordan and John Seeley-Brown provided us with the opportunity of developing a series of projects to readdress the 'interaction' between people and computers in the workplace. These projects would not have been possible without the kindness and generosity of the members of various organisations including London Underground, and in particular the Bakerloo Line, the Elms Medical Practice Liverpool (and its patients), Reuters London and Zurich, the Docklands Light Railway, and the architectural practice. John Gardner, Peter Campion, Fay Luckhurst (née Fisher), Chris Milner, Chris Pocock, Eddie Goddard, Barry Hodges, Stephen Yakeley and Phil Wardle deserve special mention for their efforts in helping to secure access to such rich and rewarding domains.

Since beginning the projects at EuroPARC we have undertaken the research at a number of universities including Surrey, Konstanz, Nottingham and King's College London. We have received much support and encouragement from academic colleagues and friends both in Britain

and abroad. They have helped us with observations, commented on presentations, scrutinised papers and provided well-deserved criticism. It would be difficult to list all those who have given such invaluable support, but it is important to name at least a few: Jon Hindmarsh, Hubert Knoblauch, Isaac Joseph, Kjeld Schmidt, Bernard Conein, Abi Sellen, Bill Gaver, Paul Dourish, Victoria Bellotti, David Greatbatch, John Gumperz, Graham Button, Wes Sharrock, William Newman, Mik Lamming, Richard Harper, Mike Robinson, Liam Bannon, Nigel Gilbert, Matthew Chalmers, Mike Molloy, Ian Daniel, Mike Flynn, Bill Buxton, Jack and Marilyn Whalen, David Middleton, Yrjö Engeström, Lauren Resnick, Mike Smyth, Elizabeth Pollitzer, Peter Campion, Charles Goodwin, Rod Watson and Steve Benford. It should be added that we have been most fortunate over the last decade to participate in the emergence of CSCW; an 'academic community' which has provided an extraordinary opportunity for sociologists and computer scientists to meet and to discuss how technologies feature, and might feature, in organisational conduct.

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A version of section 2.9 in chapter two was prepared and published with David Greatbatch. An earlier version of chapter three was written and published with G. N. Nicholls. A previous version of chapter seven was written and published with Abi Sellen.

Without the support, patience and affection of Gillian Heath, Marina Jirotka and our families this book would not have been possible.

During the preparation of this book we both suffered the sad loss of members of our families. This book is dedicated to their memory: Morris and Mary Manley, and Norman Luff.

CHRISTIAN HEATH
PAUL LUFF