Working Notes: How computers are used for collaboration at work

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Abstract

This research presents an ethnographic study of how technology is used to support collaboration at work. While "groupware" applications (computer programs designed to assist co-operation) are now widespread, there have been relatively few studies about how they are actually used. Addressing this, a study of the Lotus Notes™ groupware system is presented. Data from fieldwork shows how staff incorporated Notes into their work practice. Notes was used to manage conversations, publicly symbolise agreement, control the division of labour and provide a resource for organising company processes. These are four different ways in which Notes is used as a "device" to co-ordinate action at work.

Observations of a major Notes development project shows that the "social" aspects are an important, yet neglected, dimension of software development. Developers maintain design consensus, and close off design discussions using staff or documents to act as "proxies" for the system's end users. Ethnographic data is shown playing a similar role in development, acting as a proxy. The need to maintain consensus in the development process also explains the utility of quantitative data, in maintaining consensus amongst those involved in the design process.

In common with database systems, much of the utility of Notes comes from how it represents aspects of the world. It is shown that this "representation" is not a simple correspondence between reality and the records stored in Notes. The connection between the represented and representation is an achievement, done by having the representation "believably represent". This involves making a representation "reasonable", ensuring that it tallies with other representations, that it is seen to be updated, is authorless and is shown to have a standardised production. Data from the use of two Notes applications demonstrates how this is accomplished in practice, and in turn how databases formalise the world into a specific structured format.

These findings are drawn together to argue that Notes was used as a platform for publicly collaborating on the "making of sense" about what was going on in the organisation. It is suggested that Notes is a technology for "Computer Supported Collaborative Sensemaking". The data collected for this thesis comes from a three month ethnography of a British Oil company, along with interviews conducted in twenty four different organisations. This data is presented as a contribution to knowledge of how technology is used in practice.
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# Table of Contents

ACKNOWLEDGMENTS.................................................................................................................... IV  

TABLE OF CONTENTS .............................................................................. V

CHAPTER ONE: TECHNOLOGY AND WORK ................................................. 1

1.1 INTRODUCTION ............................................................................................... 2  
1.2 PREVIOUS STUDIES: THE MIS APPROACH ..................................................... 3  
1.3 THE WORKPLACE STUDIES MOVEMENT ......................................................... 4  
1.4 WHY STUDY LOTUS NOTES? ............................................................................. 5  
1.5 METHODOLOGY AND DATA ............................................................................ 6  
1.6 THEORY AS RESOURCE ................................................................................. 7  
1.7 OVERVIEW OF CHAPTERS .............................................................................. 9  

Chapter Two: The study of work................................................................................. 9  
Chapter Three: Notes in use ...................................................................................... 10  
Chapter Four: Making software development ......................................................... 11  
Chapter Five: Arrows, mobiles and computer databases ............................................. 12  
Chapter Six: Representations in use .......................................................................... 13  
Chapter Seven: Computer Supported Collaborative Sensemaking ............................. 14

CHAPTER TWO: STUDIES OF WORK AND COLLABORATIVE TECHNOLOGY ........16

2.1 INTRODUCTION ............................................................................................... 17  
2.2 STUDIES OF WORK ....................................................................................... 18  
   2.2.1 The sociology of work............................................................................... 19  
   2.2.2 The detail critique .................................................................................... 21  
   2.2.3 Workplace studies ................................................................................... 23  
   2.2.4 Critical conceptions of work...................................................................... 30  
   2.2.5 The history of work.................................................................................. 33  
   2.2.6 Summary................................................................................................... 36  
2.3 STUDIES OF LOTUS NOTES ................................................................. 36  
   2.3.1 Notes take one: problems with implementation ...................................... 37  
   2.3.2 Notes take two: Commercial success ..................................................... 38  
   2.3.3 Orlikowski's second study......................................................................... 39  
2.4 CONCLUSION ............................................................................................... 41

CHAPTER THREE: NOTES IN USE ................................................................. 44

3.1 INTRODUCTION ............................................................................................. 45
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.7.2</td>
<td>Databases and Formalisation</td>
<td>134</td>
</tr>
<tr>
<td>5.8</td>
<td>AN EXAMPLE OF REPRESENTATION: THE ICD</td>
<td>139</td>
</tr>
<tr>
<td>5.8.1</td>
<td>Problems</td>
<td>139</td>
</tr>
<tr>
<td>5.8.2</td>
<td>Solutions</td>
<td>140</td>
</tr>
<tr>
<td>5.9</td>
<td>THE POLITICS OF REPRESENTATION</td>
<td>141</td>
</tr>
<tr>
<td>5.10</td>
<td>CONCLUSION</td>
<td>143</td>
</tr>
<tr>
<td>6.1</td>
<td>INTRODUCTION</td>
<td>146</td>
</tr>
<tr>
<td>6.2</td>
<td>THE TIMEWRITING SYSTEM</td>
<td>148</td>
</tr>
<tr>
<td>6.2.1</td>
<td>What is timewriting?</td>
<td>148</td>
</tr>
<tr>
<td>6.2.2</td>
<td>Timewriting as a formalisation</td>
<td>148</td>
</tr>
<tr>
<td>6.2.3</td>
<td>Timewriting as an account</td>
<td>151</td>
</tr>
<tr>
<td>6.2.4</td>
<td>Maintaining Woolgar’s arrow</td>
<td>153</td>
</tr>
<tr>
<td>6.2.5</td>
<td>Changing the machinery of inscription</td>
<td>156</td>
</tr>
<tr>
<td>6.2.6</td>
<td>The working day as a social production</td>
<td>161</td>
</tr>
<tr>
<td>6.3</td>
<td>QUARTERLY REPORTING: “THE PROJECT SLIP DATABASE”</td>
<td>162</td>
</tr>
<tr>
<td>6.3.1</td>
<td>Quarterly reporting as a formalism</td>
<td>163</td>
</tr>
<tr>
<td>6.3.2</td>
<td>Quarterly reporting as an account</td>
<td>164</td>
</tr>
<tr>
<td>6.3.3</td>
<td>Quarterly reporting as a political act</td>
<td>166</td>
</tr>
<tr>
<td>6.4</td>
<td>THE ETHNOGRAPHIC ACCOUNT</td>
<td>167</td>
</tr>
<tr>
<td>6.4.1</td>
<td>The ethnographic account as a formalisation</td>
<td>168</td>
</tr>
<tr>
<td>6.4.2</td>
<td>Irony</td>
<td>170</td>
</tr>
<tr>
<td>6.5</td>
<td>SUMMARY</td>
<td>172</td>
</tr>
<tr>
<td>7.1</td>
<td>INTRODUCTION</td>
<td>181</td>
</tr>
<tr>
<td>7.2</td>
<td>GETTING THE JOB DONE</td>
<td>181</td>
</tr>
<tr>
<td>7.3</td>
<td>CONSTRUCTING THE MACHINE</td>
<td>183</td>
</tr>
<tr>
<td>7.3.1</td>
<td>Devices for the production of formalised, ordered accounts</td>
<td>183</td>
</tr>
<tr>
<td>7.3.2</td>
<td>Achieving a believable account</td>
<td>186</td>
</tr>
<tr>
<td>7.4</td>
<td>DAY TO DAY USE OF A NOTES DATABASE</td>
<td>188</td>
</tr>
<tr>
<td>7.4.1</td>
<td>Control, accounts and politics</td>
<td>189</td>
</tr>
<tr>
<td>7.5</td>
<td>COMPUTER SUPPORT FOR COLLABORATIVE SENSEMAKING</td>
<td>190</td>
</tr>
<tr>
<td>7.6</td>
<td>GENERALISING FROM NARAO</td>
<td>191</td>
</tr>
<tr>
<td>7.7</td>
<td>THE VALUE OF STUDYING USE</td>
<td>192</td>
</tr>
</tbody>
</table>

BIBLIOGRAPHY | 194 |
Chapter One:
Technology and Work
1.1 Introduction

All things considered, it looks as though Utopia were far closer to us than anyone, only fifteen years ago, could have imagined. Then, I projected it six hundred years into the future. Today it seems quite possible that the horror may be upon us within a single century.

Aldous Huxley, Foreword to Brave New World (1946)

Computers, it seems, are everywhere. The popular media talks about a "new industrial revolution", and weaves technology into stories of either future utopia or future disaster\(^1\). The future of work, it seems, is intimately connected with the future of technology, although there is little consensus about what this implies.

This interest is shared by academics. A number of different fields actively research aspects of computers, technology and work. But how much do we actually know about the use of computers in real workplaces? This thesis suggests that we know surprising little, for despite all the attention given to computers there is a paucity of in-depth empirical work on how it is that computers are actually used. In an attempt to generalise, many of the details of how technology is used in real settings has been lost. Most research has shied away from detailed examination of the use of technology, instead presenting overtly managerial or technological accounts of computer use (Kling and Iacono, 1988). As Blackler laments, research is often nothing more than "strong rhetoric, which often hints that the future will be determined by new technological developments" (Blackler, 1994)\(^2\)

Accordingly, the study presented here is an detailed empirical examination of one computer system in use. "Lotus Notes" has sold over twenty million copies worldwide (Papows, 1998), and is used in many large organisations such as Price Waterhouse, J.P. Morgan and Kodak-Eastman. Despite this success Notes is something of an enigma. For unlike the majority of computer applications Notes is designed to facilitate individuals collaborating rather than working individually. It is a "groupware" system, designed to help people co-operate.

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\(^1\) A 1995 television program on this topic was titled "Heaven or Hell?" (Channel Four, 1995). (Kling, 1994) discusses these different genres of technology writing.

\(^2\) It is not hard to find the work which Blacker refers to. (Sproull and Kiesler, 1991; Hiltz and Turoff, 1993) are two of the better books which are overly optimistic about technology.
Many recent computer innovations, such as email, video conferencing and the world wide web, are useful not only because they help the individual work, but also because they help individuals work together. Increasingly technology is being designed to help people collaborate, although often with only partial success. If this is ever to reach its full potential it seem important that we understand how technology can help people collaborate in real settings.

Unlike the world wide web, which is based around a model of one writer and many readers, Notes allows any number of people to contribute and read information held on computers. This has made Notes the most popular "groupware" system currently available (Lloyd and Whitehead, 1996). To understand collaboration with technology, Notes seems an ideal place to start. Along with interviews in twenty four organisations which use Lotus Notes, three months was spent as a participant observer in a large British based company - Narajo Oil3 - which had used Lotus Notes extensively for over three years. The results from this are presented in the next six chapters.

1.2 Previous studies: The MIS approach

Since the 1960s, a number of research fields have studied "Information Systems" (IS). Peer review journals and conferences have contributed to an accumulating body of research findings. While work is dispersed, the central research field for discussing technology and work has been Management Information Systems (MIS), covered by journals such as MIS Quarterly, Information Systems Research and ACM transactions on computer systems.

Despite this attention many questions about computers and work are still unanswered. In terms of its research questions, MIS is dominated by a framework which severely limits which questions can be asked regarding technology use. The MIS literature has often uncritically seen technology as a universally applicable dependent variable (Sahay, 1997). Some writers have even gone as far as seeing the job of MIS to be to develop and measure suitable variables for the success of technology. As Delone and McLean write:

> Without a well defined variable, much of IS research is purely speculative.  
> (Delone and McLean, 1992)

This reduces explaining and understanding technology to a excessive simplicity. The study of IS systems cannot be reduced to a variable without doing great violence to

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3"Narajo Oil" is a pseudonym for the company's real name. All the names throughout this report have been replaced with pseudonyms to preserve anonymity.
what is being studied. "Technology" cannot be reduced to a simple "dependent variable" (Keen, 1980), it is a detailed invention with different forms, uses and applications. If research is to limit itself to only dealing with variables, then the different ways in which technology is used, is designed, is worked with and around are lost.

Thus this MIS viewpoint has left many "what" questions regarding technology unanswered: What happens when technology is used in the professional workplace? What is technology used for? What problems are overcome in getting this technology to work? These are not easy questions to answer concretely, since answers take the form of stories of technology being used, stories of technology failing and so on, rather than correlations, or statistical "data". Engaging these questions, however, is essential to understanding technology and work in any sort of detail. As Bloomberg puts it:

> It is curious that more attention has not been focused on the ways in which individuals actually accomplish their work in environments highly dependent on new office technologies (Blomberg, 1987)

### 1.3 The Workplace Studies movement

Criticisms of the MIS approach can be traced back to the late seventies, such as Kling's criticisms of "managerial rationalism" in an influential review paper (Kling, 1980). Although recently there has been moves away from this narrow viewpoint, this is still an exception rather than the rule (Walsham, 1995). Indeed, one paper reports on a "crisis" for qualitative research in MIS (King and Applegate, 1997).

As is discussed in depth later in chapter two, other research fields have developed which have rejected the narrow outlook of the MIS approach. During the 1990s "Computer Supported Collaborative Work" (CSCW), a field which grew out of Computer-Human Interaction (CHI) research, developed in reaction to similar concerns with limited frameworks⁴. Within CSCW a research program for understanding technology in use has developed. Central to this is the maxim that one must study *in depth* how technology is used in the workplace. This has motivated the "workplace studies" movement - a number of different research groups which take their topic of study to be how work is done.

Workplace studies take seriously the study of "technology use" as a topic in itself. It might seem that this would be the focus for IS research, but even a casual review of

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⁴This motivation combined with a number of other concerns to form CSCW (Blomberg, 1995).
the literature shows that how a technology is used in practice has not been given much attention in the MIS field. Whether a particular technology is actually used, how technology is designed, its design features, the external effects on users, and so on, have been research topics. But MIS researchers have left a key topic unanswered. What are applications used for? How is, for example, a word processor used? Researchers seem to have been happy with the literal description, "word process", rather than asking what this invention comes to be used for. Has it changed the nature of report writing? Has it made reports more common? Has electronic distribution been popular? It is these sort of topics, topics which have been previous ignored, which workplace studies take as their subject matter. As Orr puts it:

[T]he intent of this work is to describe skilled practice, to show how varied and demanding is the work when seen in detail, and then to show how often things develop from that practice. In any sort of work, something has to be done, and it is that accomplishment which makes possible all else that work accomplishes in society. Discussions of work which omit this vital aspect of practice lose the point from which anything else that may be described originates (p158, Orr, 1996)

1.4 Why study Lotus Notes?

This study looks specifically at one technology in depth: "Lotus Notes", an application which was first released in 1990 by Lotus Development Inc., and since has achieved some success. Focusing specifically on Notes gives a number of advantages. In abandoning talk about "technology" as if it was an unified whole, we can instead study in depth the details of one particular application. Attention can be focused on the details of Notes in use and how it is integrated into different work tasks.

This raises a further question: what is specifically interesting in Lotus Notes? One lesson from the success of the Internet is that technology is no longer concerned with just individual computers, but also with what connecting those computers together makes possible. With regard to this, Notes is a pioneering application which demonstrates how individuals can use computers to co-ordinate their activities. As a successful collaboration technology, how it is used for collaboration becomes an interesting topic.

The design of Notes is fairly straightforward. It is based around the sharing of "Notes databases" held on computer. These databases are designed to store information in a flexible way while adding some structure. Since a Notes user can share databases over a computer network, information can be distributed between Notes users. Databases might contain anything: company reports, telephone numbers, in fact any sort of data which can be put into a computer can be shared in a Notes database.
While this is a description of what Notes can do, it does not describe what actually is done. Although some research has covered this on a general level (see chapter two), the question of how Notes is actually used is still unanswered. That Notes is used, and is useful to the organisations studied here, suggests that studying Notes will help to explain what co-operating with technology involves. The question this research is to answer, then, is what is actually done with Notes?

Understanding use would contribute to the development of future collaborative technology, since by seeing how technology is used we can see how to design it better to support that use. Just as important as this, however, is that understanding technology use is a topic of interest in itself. How individuals use technology is not determined by the computer manual or the design of the system. Instead, by looking at how technology becomes integrated into the workplace we can expose an area of artful use, of the integration of technology into "getting the job done", whatever that may involve. As technology becomes more and more ubiquitous, if we are to understand work we must also take on the challenge of understanding how technology fits in with work. Understanding technology use is thus a crucial part of understanding work.

1.5 Methodology and Data

Studying the use of a technology involves collecting empirical data, and since the question we are asking requires descriptive answers, this suggests that our data must be descriptive and qualitative. There is a long tradition of qualitative research in sociology, particularly with the use of ethnography as a research technique. Ethnography is based around prolonged in-depth study in the site of interest, collecting observations of 'what is going on' (Hammersley and Atkinson, 1995). The main data collection technique is participant observation, actually taking part in the activity being studied for a prolonged period of time, anything between a month and a number of years. (Loftland, 1971; Morgan and Smircich, 1980; Burgess, 1984; Hammersley, 1985; Bryman, 1988; Goffman, 1989; Rosen, 1991; Fine, 1993) discuss its use in Sociology and (Benbasat, Goldstein et al., 1987; Anderson, 1994; Brown and Duguid, 1994; Shapiro, 1994; Walsham and Waema, 1994; Lee, Liebenau et al., 1997) with regard to the study of technology.

To supplement the data from participant observation, other techniques have also been used such as unstructured interviews. In all, five main sets of data were collected:

1. Three months spent as a participant observer at the British headquarters of Narajo Oil, a large company using Notes

2. Informal interviews with staff within Narjao who used Notes
3. Interviews with the users of a Notes help desk system at a British software company

4. Interviews with 28 managers in 24 companies using Notes

5. Participant observation taken as part of a short study of a failed attempt to introduce Notes into a electrical company

In addition a number of informal interviews were conducted with computer consultants involved in the groupware field. The main data segment, however, is the three months participant observation at Narajo Oil. Narajo had been using Notes for over three years when I studied them and, to quote a worker at Narajo:

"It is just about impossible to do your job at Narajo Oil without using Notes." (rco/MB)

While researching Narajo, I participated in the IS (Information Systems) department as a part-time programmer on a new computerised timesheet system. Working part time gave me access to the different departments in Narajo, access I used to conduct interviews with staff company wide. In addition, since much of the Notes system used at Narajo was open access, I was able to monitor different parts of the Notes system electronically. Notes was also heavily used within the department in which I worked, providing an opportunity to study its use physically in situ. Working in IS allowed me to become a member of staff at Narajo, since I could take part in all the meetings and had a reasonably straightforward reason to be in the company, but working part time, I still had time to observe and interview staff throughout Narajo about their activities.

The data from this was then collated and indexed, along with the other data sources. This data was catalogued for analytic themes, and along with my own recollections, used to build the answers and themes discussed in the following chapters. The method of analysis is discussed (and critiqued) in more detail in chapter six.

1.6 Theory as resource

Sociological theory has often been used in combination with ethnography as a device to inform an understanding of what is being studied. An argument in a work site, for example, can be made to 'make sense' by using labour process theory (Knights and Wilmott, 1988). This suggests that conflicts in the workplace are manifestations of greater structural forces. An argument in the workplace could be a manifestation of conflict between pressures for work to be deskill ed and worker resistance to that deskill ing. The theory helps to facilitate an analysis from the data. In this way a theory can guide fieldwork in that it provides a motivation for looking at particular
events or observing certain aspects of work. An interest in deskillling might motivate a researcher to study how staff conceive of "skill" and how the notion is used with regard to different jobs, or to measure the levels of skill in a firm over time. Theory brings certain aspects of the workplace into relief as "of interest".

For a study such as this, however, much of social theory is almost irrelevant. It often seems that the everyday world of activity - what people do - is something which is of no interest to social theorists (Sharrock and Anderson, 1986). Mainstream social theory is still very much concerned with describing grand concepts such as "society" or "modernism". Organisational theory is similarly motivated: its major topics are the explanation of "macro" phenomena, such as post-fordism or professional power. The detail of how work is done has been ignored. As Orr puts it:

This is the main problem with all this literature. It is not well grounded in analysis of work practice, so its presumptions and prescriptions of what is to be done are not based on what is done and what needs to be done, on the reality of the job, the task to be accomplished. (p151, Orr, 1996)

This has led those who conduct workplace studies towards the work of the ethnomethodologists, a somewhat marginal grouping in mainstream sociology, but one intimately concerned with the details of practice, the description of the details of work. At its simplest, ethnomethodology is the study of the everyday means by which individuals go about their day to day lives. Its rather cumbersome name comes from this topic: thus, "ethno" - people, and "methodology" - methods. Ethnomethodology is a call for researchers to look at how the taken for granted nature of society - truth, lies, order and so on - is produced by the actions of those involved. As Garfinkel puts it in a typically quirky reinterpretation of Durkheim, it is the study of the objective reality of social facts (Garfinkel, 1996). That is, the study of the way that the objective reality of social facts comes about, how we produce an objectively real world of social facts. This call from ethnomethodology and the devices it provides to researchers have been an invaluable resource for those who seek to study the details of work, including the work in this report.

This study is, however, not an ethnomethodological one. This distinction is an important one to make. Ethnomethodology as a research program has always been intimately concerned with the grounds on which it presents its findings. It is an irony that when ethnomethodology was founded in the early 60s, it was so far ahead of the sociology of the day that it was thought by many that it avoided this question (p145, Lynch, 1994). This could not be further from the truth - ethnomethodology took on board philosophers such as Wittgenstein long before Lyotard's declaration of post modernism influenced mainstream sociology (Lyotard, 1984). It is because of this
concern that writers such as Garfinkel and Lynch have moved towards demands of research that they follow the 'unique adequacy requirement' or 'post analytic ethnomethodology' (Garfinkel and Weider, 1992; Lynch, 1993). These are difficult - but powerfully argued - attempts to create a sound epistemological basis for the social sciences. They are attempts to produce a program of rigorous study of social reality, which, if successful, would affect all the social sciences.

The problem with these approaches - and why I have rejected them - is that they seek to use philosophy as topic rather than resource. Philosophy becomes the master of what one can say, rather than an aid to understanding (Chapter two, Luff, 1997). A research project like this one is very much a practical undertaking. I am attempting to understand the use of technology, and this mandates a certain compromise with high theory\(^5\). In this way I echo the inelegant yet honest claim to be working on "ethnomethodologically-informed ethnography" (Randall, Rouncefield et al., 1995).

1.7 Overview of chapters

The chapters which follow describe different aspects of how Notes was used in actual organisations. Each chapter takes on one aspect and investigates it in detail. A short sketch of each chapter demonstrates where this investigation has led:

**Chapter Two: The study of work**

Chapter Two leads on from this chapter by reviewing the research which has analysed the use of technology in the workplace. As mentioned above, there are many limitations with this literature, not least a brevity in the analysis and a trend to speculate rather than describe empirical data. This leads us to what I have called "the detail critique" - the stance of a number of authors who argue that existing studies have ignored the details of how work is actually done. Even well regarded ethnographic studies can be criticised for only analysing the events observed in abstract terms, distant from what actually happens. Exploring this critique with a number of examples shows that this "distance" is a side effect of the need to produce an analysis of work. For in attempting to produce an analysis, the details of work can appear insufficiently interesting to be presented just as they are. Even a well organised account of "just what happens" reads as reportage, not sociology. Unfortunately, the conventional solutions used to avoid this, the devices of sociological analysis, move the discussion away from the fieldwork and onto

\(^5\)The falsificationists - while philosophically very different - put similarly unrealistic limits onto scientific research in the name of philosophical correctness (chapter four, Chalmers, 1978).
analytical concepts. The result is that the details do not end up having the analytic import that they should.

This need not be the case. Ethnomethodology is one approach which can be used to analyse the details of work. This allows them to be analytically discussed without resort to macro-sociological concepts. Alternatively, studies which are more anthropologically informed make less explicit use of theoretical devices, yet demonstrate a close understanding of those being studied. However, there are two aspects which are missing from these studies. The first is any attempt at a critical stance on work and the second is any concept of the historical development of work practice. Accordingly, studies which address these problems are investigated in turn. Yates and Chandler investigate the history of the development of work, going some way to explaining how the current state of work organisation developed. Kraft and Klein (Klein and Kraft, 1994) show how a critical stance on work can be developed, in particular through the application of labour process theory.

From this position, the chapter then moves on to review the work which has been done on the use of Lotus Notes. There are few empirical studies of Notes, or indeed collaborative software generally and those studies which have looked at Notes have avoided detailed descriptions of its use, considering instead issues such as implementation problems or staff perceptions. This has led one author to call for detailed descriptions of Notes in the workplace. This sets up a position for the development of the rest of this thesis: an attempt to understand the details of how Notes is used in practice.

Chapter Three: Notes in use

Chapter three starts the study off properly by attempting to answer the research question posed earlier: What is done with Notes? Unstructured interviews with staff in 20 companies who used Notes provides the first part of the answer, an insight into how Notes is generally used in organisations. Notes users divided into two groups. One group had Notes installed only on a selection of their computers and often used Notes for just one application. While Notes was useful to these companies, it was seen as fairly unremarkable - just another database system. This was in contrast to "Notes committed" organisations which had Notes on every computer and often used Notes for all their in-house software development. In these companies Notes was part of their technology infrastructure, and often central to how their organisation ran.

Narajo Oil, the company studied in the ethnography, used Notes this way. In Narajo, Notes was a natural and important part of how staff got their work done. Everyday tasks which all staff needed to do, such as booking meeting rooms, required the use of
Notes database. There was sanctions for not using Notes, such as with the "challenge" database where contributing effectively meant missing out on the Christmas bonus.

Most studies of Notes have stopped at this point, with just a description of different Notes databases. However, studying use shows how these databases were used as "devices", incorporated into the work to help get the job done. For example, the vendor information database was designed to keep track of companies who wanted to sell their services to Narajo. But to the purchasing administrator the database became a device to get sales people off the phone. Since Narajo would not do business with a company without them being in the database, the administrator could insist that salespeople complete a form, faxed to them from the database, before she would talk to them. This redirected the salesperson's spiel onto the paper form where it could be dealt with easier than over the phone. The vendor database was therefore used as an interactional device. Studying the use of Notes highlights four other ways in which Notes can be incorporated into the work: as symbolic devices, as political devices and as ordering devices. This makes an important point about how technology is used. Technology use is not determined by its design but rather is a creative activity, and one which is important enough to be studied in itself.

Chapter Four: Making software development

Chapter four discusses the IS department at Narajo, focusing on the social and organisational sides of software development. That is, the tasks and actions which are not concerned with merely instructing a computer what to do. Since much of the in-house development was done using Notes, software development is an important aspect of Notes. One cornerstone assumption of IS is that there are two different types of computer operation: software use and software development. Software development is taken to be the creation of software (of all shapes and forms), an activity which is self-evidently different from software use. The first part of the chapter looks again at this division, showing that it is not pre-ordained but is instead created by the way IS development is arranged. While it is difficult to break a cornerstone assumption, by comparing development of software in Notes and the development of spreadsheets, the divide between use and development can be seen as actively produced.

The second part of chapter four addresses how staff managed the day to day job of development, and the problems that they needed to overcome in getting that work done. One major problem was the need to get a handle on "who the users were". During the development process, developers needed a notion of "the users" so as to be able to make design decisions and defend them when challenged. 'User proxying' was
one device used to achieve this. People or materials were used to stand for the
difficult mass of users. The proxy individuals or materials could be consulted instead
of the difficult (and sometimes impossible) task of going to the users themselves.

This was in turn part of the job of achieving agreement, an essential part of
development. Since design decisions were taken in consultation with users and
management, agreement needed to be maintained in order to be able to proceed.
Disagreement could halt progress on the project. This also suggests a reason why
developers have been hesitant to adopt requirements analysis techniques which open
up design discussions, such as ethnography. Developers need to conclude design
discussions and reach agreement during projects, so they are more interested in
techniques which help them to close discussion, rather than ethnography which 'opens
up' the process.

Lastly, the importance IS staff attached to appearing professional is discussed. As a
member of IS it was important to maintain relationships with other individuals in the
organisation. Part of this was the maintenance of professionalism, important in
convincing other departments of IS's organisational worth and the competence of the
staff within it. Looking at deviations from professionalism, and how they were dealt
with, highlights the way in which professionalism was an important part of doing
"good IS" to the staff at Narajo.

Chapter Five: Arrows, mobiles and computer databases

One finding discussed in chapter three is that there were few databases at Narajo in
which electronic "conversations" developed. However, collaborative technology is
conventionally described as a way of holding electronic conversations, as a form of
electronic conferencing (Hiltz and Turoff, 1978; Quartermar, 1990; Jirotka, Luff et
al., 1991; Sproull and Kiesler, 1991). At Narajo these electronic conferences seemed
incidental to how Notes was used and databases set up specifically for this purpose
failed through lack of interest. Despite this, Notes was still used very successfully for
collaboration. This suggests that to understand collaboration using Notes we must
move away from considering Notes as a form of communication and look at other
ways to conceptualise how it is used. Chapter five discusses how Notes can be
thought of as a means of representation. Notes was used to represent the world.

The chapter starts by asking how it is that a database represents the world. How is the
meaning of items in a database established? This question is a variant of a very old
philosophical question, the question of how something (like language) can be read as
representing something else. For this study one solution to this problem is particularly
interesting. Lynch has argued, following Wittgenstein, that to understand
representation we should study representation as an activity. That is, to understand representations one should study how they are actually used. This provides an interesting direction for an ethnographic study. How databases represent the world can be seen by looking at how they are used in particular work environments.

This leads to other studies of 'representing' that have been conducted in sociology, and in particular two writers from the sociology of science: Steve Woolgar and Bruno Latour. Woolgar's social constructivist view of scientific representations shows that representation, can be investigated as an "achievement". The fact that something is taken to represent something else is the result of actions by individuals to establish that representation as valid. Woolgar's discussion of how representations in science are established can be extended, with some modifications, to computer databases such as Notes. This lets us see how staff do work to make Notes databases appear 'representative', connecting them with what they represent.

Alternatively, Latour's writing suggest why it is that representations are useful to modern organisations. Latour writes about "immutable mobiles", artefacts which can transmit information from one setting to another without distorting that information. Computer databases are one type of immutable mobile, in that they allow information to be packaged and transmitted from one setting to another. In doing so they formalise the world, making it easier to deal with vast amounts of information which would otherwise be unmanageable. The way databases formalise the world is discussed, looking at how it is that they manage to fit nearly any phenomena into a structured, ordered format. It is this formalisation which make them so powerful: their ability to turn chaos into manageable order.

Chapter Six: Representations in use

While chapter five covers the notion of representation conceptually, what remains to be shown is how it is that these Notes databases actually support collaboration in a real organisation. To this end, chapter six takes a look at the use of two Lotus Notes databases from Narajo, applying the discussion of the previous chapter to understand their use.

The first database examined is the company wide timesheet database, which I worked on during my time at Narajo. This database was used by staff to complete monthly reports of the time they worked on the various company projects. While timesheets might seem a fairly mundane device, they achieve something quite interesting. The timesheet database managed to reduce the whole world of work, in all its complexity and variety, to a small number of predefined codes. This is the power of formalisation, its ability to reduce the details of a large organisation to a list of figures.
Looking at how the timesheet was actually used reveals how formalisations are applied in practice. A timesheet was not an actuarial record. There was no one-to-one mapping between what staff did during the day and what they put on the timesheet. Instead, it was a practical record, one where the aim was to produce a 'reasonable account', rather than one which was representationally accurate. In practice the representation was a judicious balance between politics, formalisation and accuracy. It came to be a 'good enough account' for the purposes to which it was put.

Moreover, since the timesheet system originally existed using paper forms, it is possible to compare the timesheet system in both paper and computer. This highlights the differences between computer and paper based systems, and in particular, the ways in which computers have the ability to restrict and control what can be done with a timesheet.

The second database to be examined, the "Quarterly Reports database", highlights similar issues. This database was used to track progress on IS development projects, producing a report which was presented to management every quarter. However, its role as an account of work to management, and the nature of its design, meant that its use was somewhat contentious. The database framed work in an inherently negative light, in that it only detailed in its reports how much projects were behind time ('slippage'). This took control away from staff of how they presented their work, since they had no avenue for explaining why a project had slipped. This caused considerable resistance to its use. Since this account was formed in a manner the staff took exception to, the database came to be used primarily as a political object.

For a last example we leave Narajo and take a short reflexive 'play' on the status of this report. For while the last chapter considered representations at Narajo, this report itself is a representation too. Like the databases described, ethnography can be described as a process of "formalisation" and the chains by which field work becomes the completed argument are another case of "maintaining Woolgar's arrow". This presents us with a problem of ontological gerrymandering. That is, how can we criticise others' truth claims while claiming a status for one's own? If to study the construction of databases inherently ironicise the account in those databases, must we also ironicise our own account? The solution to this conundrum seeks to show that studying the construction of an account does not necessarily discredit its truth value.

Chapter Seven: Computer Supported Collaborative Sensemaking

Chapter seven reviews the work in the other chapters and brings this thesis to a conclusion. In integrating together the different themes discussed, it returns to the
original research question posed at the beginning of this chapter: What do people actually do with Notes?

The solution to this question comes from understanding what role databases played in the jobs of staff at Narajo. For in using a Notes database, staff produced an ordered account of the world, held within that database. That is, the description held in Notes would be an ordered and sensible description of the activities which went on around the database. This way, Notes databases were used to make sense of what was going on. By referring to the Notes database one could read a sensible description of the work at Narajo. Be it in terms of the slippage of IS projects, or the time worked by staff, the database would always present Narajo as an ordered entity.

When representations are produced in Notes this way, they are being used by staff to "work up" a description of the world, in the form of a Notes database. Keeping track of the world in a Notes database helps to order the work, presenting it in terms designed into the database. Notes was thus used at Narajo to "make sense" of Narajo, a process of 'computer supported collaborative sensemaking'.

In sum, this thesis is an attempt to understand how a technology like Notes is used to help co-ordination at work. Looking in depth using an ethnographic study, it presents a story of creative use, of a technology incorporated into work in an original and interesting way. The details of this incorporation is the story of this thesis. This gives a direction for future work on collaborative technology, and also gives encouragement to the study of the use of technology as an end in itself.
Chapter Two:
Studies of work and collaborative technology
A discussion and critical review of relevant literature
2.1 Introduction

As mentioned in the last chapter this thesis is a study of how it is that technology comes to be used in the workplace. While sociology has had a long-standing interest in work and technology it is only recently that this topic has come under sustained ethnographic enquiry. While many of the classic sociological studies of work used ethnography, these studied did not directly concern themselves with technology. Alternatively, the sociology of technology has been mainly conducted at arms length from the actual sites of technology use. The effects of technology have been discussed with little empirical evidence. This situation has been exacerbated by a general ignorance - and sometimes downright hostility - to sociology in the computing sciences.

However, since the late 1980s a number of different researchers have begun to conduct ethnographies of technology at work. The major research field in which these studies have been presented is *Computer Supported Collaborative Work* (CSCW). CSCW addresses the design and use of technologies used for collaboration, of which Lotus Notes is one. The focus on design in CSCW has motivated detailed empirical descriptions of work settings, studies which have come to be known as "workplace studies" (Plowman, Rogers et al., 1995). Workplace studies have been conducted in a number of different settings, with an interest in the use of technology and to understanding how work itself is done. As Heath, Jirotka et al put it, there is a need for these studies because:

> our relative ignorance of the organisation of co-operative and collaborative activities in work settings may have profound implications for the success of technologies we are attempting to develop (p148, Heath, Jirotka et al., 1993)

This chapter reviews this research, looking at how both technology and work have been empirically examined. It starts, however, by reviewing the classical sociological view of work. For while workplace studies have flourished in CSCW, their roots lie in sociology. Workplace studies often base themselves around a critique of the mainstream sociology of work, arguing that it analyses work in abstract terms which

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6 (Beniger, 1986) describes over forty different writers who had predicted some sort of technological revolution since the 1950s, few of them with any sort of empirical evidence.

7 For example, DeMills's paper on the social nature of formal proofs prompted a reply from a leading computer scientist entitled "on a political pamphlet from the middle ages" (Dijkstra, 1978; De Millo, Lipton et al., 1979; MacKenzie, 1993). Computer science has been very much a technical discipline since its foundation. This hostility can also be seen in many of the computer management journals, although this is changing (Walsham, 1995).
are distant from the details of what is actually done in the workplace. This is the 'detail critique'.

Section 2.2.1 shows how this can be seen in Weber's work on organisations. Weber discussed how action in bureaucracies could be seen as rule following behaviour. Here, from the very beginning of the sociology of work, it is described in abstract terms, distant from how it is actually carried out. Much of the classic research in the sociology of work carries this on. Crozier and Blau (Blau, 1963; Crozier, 1964), for example, while they describe the details of work, never treat these discussions as having any analytic import. The way "things are organised" is described but rarely is it itself the subject of analysis. One reason for this is the need for sociological accounts of field studies - ethnography - to distance themselves from mere reportage. The problem is that the details of what is "actually done" in the workplace are seldom interesting enough to be presented as is.

Even a well-organised discussion of "what happened", a naturalistic account, lacks the analytic leverage to be an adequate sociological account. Sociology is not reportage. Solutions to this problem have led sociological field studies of work away from the details of work and to the use of analytical concepts. However, as workplace studies show, it is possible to produce analysis of the details of work without this analytic distance. Workplace studies have presented analytical accounts of the actual details of what is done in work settings. These studies often make use of an ethnomethodological stance to overcome the limitations of reportage. Ethnomethodology can allow one to take seriously the details of how work is done. Ethnomethodology can be used to gain an analytic handle on the mundane details of work, while not trivialising those details.

After discussing these different studies of work, this chapter addresses studies of technology and in particular field studies of Lotus Notes. Early studies of Notes focused on failed implementation, including one heavily cited early paper by Orlikowski (Orlikowski, 1992). Later studies, however, have begun to uncover how Notes does get used in situations where it has been relatively successful. While an improvement, these studies still remain distant from the details of how Notes is actually used. Taking on the observations of the detail critique, this sets up the aim of this report to examine the details of use of Notes, and in particular how Notes fits in with the work environment.

2.2 Studies of work

One of the most important areas of study within the CSCW field has been the study of co-operative work. This has been motivated by a realisation that "to understand
human machine interaction one has to look at the socially situated nature of those interactions" (Blomberg, 1995). To design better technology one needs to have a better view of the context in which it will be used. In its most general sense we can take work to mean any collection of purposeful actions which are aimed towards some goal, although normally this is limited to actions which are done as part of some form of employment\(^8\). Within this definition there is a huge variety: one could decide to look at the relations between waiters and kitchen staff in a restaurant (Whyte, 1949), doctors (Becker, Geer et al., 1961), or the policing of 'skid row' (Bittner, 1967).

### 2.2.1 The sociology of work

While workplace studies have their roots in the sociology of work, they make an important break from this with "the detail critique" – a criticism regarding how the sociology of work has developed. The sociology of work is a large area (Burns, 1969; Grint, 1991), but to demonstrate the detail critique we can examine the notion of "rule following behaviour" starting with the work of Weber, and in particular his discussion of organisations. A key concept in Weber's discussion of work was that of the rational bureaucracy, that is, an organisation of appointed officials who work through the authority vested in the office that they hold, implementing impersonal rules designed to achieve the organisation's goals. Weber thought that bureaucracies had a series of characteristics which made them the technically most satisfactory of organisations:

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\text{The decisive reason for the advance of bureaucratic organisation has always been its purely technical superiority over any other form of organisation. The fully developed bureaucratic mechanism compares with other organisations exactly as does the machine with the non-mechanical modes of production. Precision, speed, unambiguity, knowledge of the files, continuity, discretion, unity, strict subordination, reduction of friction and of material and personal costs — these are raised to the optimum point in the strictly bureaucratic administration. (p75, Weber, 1971)}
\]

Central to this is the notion of rules, rules used by organisational members to conduct their work. To Weber, all action in a rational bureaucracy is governed by "a consistent system of abstract rules ... [and] consist in the application of these rules to particular cases" (p70). The work of individuals in the organisation consists of applying a set of rules to situations encountered - rule governed behaviour.

Weber's discussions of rationality and rule following have been a source of much controversy. Perhaps the most famous criticism has been Merton's observation that while rules are designed as means to ends, they can also become ends in themselves.

\(^8\)This is not to ignore the fact that like most terms in sociology, there is considerable controversy over this. See chapter one in (Grint, 1991) for example.
The following of rules may lead to irrational behaviour as rules are followed even though they conflict with the goals for which they were originally designed. Merton drew a distinction between *rational* behaviour and *rule following* behaviour that Weber seemed to ignore.

A related criticism can be seen in the work of Blau, and in particular his ethnography of a government employment agency (Blau, 1963). Blau pointed out that staff in the agency he studied would often ignore the rules which they were meant to follow, so as to get their job done in a more efficient way. While staff were trained in how to use a 29,000 code classification of occupations to match work with employees, they discarded this in the actual worksite. The department Blau studied served the clothing industry, where only a few occupations were available and staff were needed to fill vacancies almost immediately after they fell open. This meant that job applicants would be picked directly from the flow of incoming clients and sent to an interview that day. For the purpose of maintaining the effective operation of the agency, the staff had changed the rules to fit better their situation. Staff ignored, or reinterpreted rules with regard to the needs of the local situation. Blau points out that staff chose when they did or did not follow organisational rules. In contrast to Weber’s notion of organisations running like machines, he shows that rules are contingently used when appropriate.

However, even this stance is open to a more radical critique. Zimmerman questions the notion that behaviour can be seen as rule following or breaking:

> Such a procedure would seem to require, first of all, that the investigator “map out” the alternative possible behavioural dispositions called for by the rules. However, such decisions are typically made on an ad hoc basis. The investigator determines the deviant or conforming status of some activity or event upon encountering it without reference to a set of unambiguous criteria that specify the defining features of situations and the behaviours appropriate to such situations. By whatever means the investigator accomplishes these critical decisions, it is typically the case that the issue of what such rules mean to, and how they are used by, personnel on actual occasions of bureaucratic work is ignored as an empirical issue. (p223, Zimmerman, 1971)

Writers following Weber have made use of a notions of behaviour as either following (or not following) rules, without consideration for how it is that rules are actually interpreted *in situ*. The actual use of rules in working situations has been ignored. Organisational rules become a device for discussing action in organisations, rather than as a *device used by organisational members to help achieve their work* (Bittner, 1965). What Zimmerman is doing here is a making a critique of the level of *detail* in sociological studies of work. Studies have ignored what it is that staff actually do,
instead preferring to discuss a rarefied descriptions of work as either "rule following" or "rule breaking" behaviour.

2.2.2 The detail critique

This criticism has been one of the central motivations for workplace studies, and of attempts to study the details of work in more detail. In the introduction to Orr's study of photocopy engineers, Barley forcefully argues that we know very little about work:

One conversation is notably but a murmur: what do people do in this new economy? Amid the dust of the rush to downsize, re-engineer, compete, compute, empower and predict, work has almost disappeared from sight ...

What meaning can the "service economy", the "information economy", the "knowledge economy", and similar terms have unless they denote substantive changes either in what people do for a living or how they do it? The obvious answer is, very little. Yet journalists, futurists, and even sociologists routinely employ such epithets without explaining precisely what kinds of work they have in mind ... The upshot is that millions of people go to work each day to do things that almost no one but themselves understands but which large numbers of people believe they know enough about to set policy, offer advice or redesign. Work has become invisible (Orr, 1996, pages x-xi)

This is not a new criticism. Mintzberg in 1967 complained that:

Although an enormous amount of material has been published on the manager's job, we continue to know very little about it. Much of the literature is of very little use, being merely endless repetition of the same vague statements. (Mintzberg, 1973)

and Strauss et al put it clearly when they complain that:

most writings that comprise the "sociology of work" turn out, on scanning, really to be about occupations or professions and the organisations worked in. (Strauss, Shizuko et al., 1985)

More specifically, with regard to technology:

If studies done in terms of this announced interest in the content of technology are examined, it seems that the content of technology, far from being visible, has mysteriously vanished in the course of the investigation. ... Barker and Downing's (1985) account of the introduction of word processing in the office is not an account of actual use of word processing... a whole world is lost to the sociologist (p15 and p18, Button, 1993)

and the design of computer systems:

Empirical sociology has demonstrated an extraordinary unwillingness to address the details of work and its activities with anything like the
attention that is needed for system design. Typically, the conventional sociology of work takes for granted the details of the work itself in favour of rather gross typifications, which, it is argued, display the social character of the work ... What these do not do is tell you about what the work consists of except as decontextualized 'examples'. (p144, Randall and Hughes)

While the various authors quoted here are attempting to advance very different conceptions of work, they share a common argument. The sociology of work has failed to describe work in anything like the required detail and has concerned itself with either politics or general typification.

On closer examination, however, it is not entirely fair to say that the sociology of work has failed to discuss the details of work itself. Blau's study, for example, includes a number of "matter of fact" descriptions of work practice of a sort which could only have been revealed through close observation. The same can be seen in Crozier (Crozier, 1964), Hughes (Hughes, 1958) and other classics in the sociology of work. Roy's paper *Banana time: job satisfaction and informal interaction* (Roy, 1960), for example, is a beautifully observed description of techniques used to manage the monotony of a potentially soul destroying job. At varying points during the day, Roy's fellow workers would produce a pear, a banana, a coke or some such food and along with the horseplay around these events this would help to pass a day otherwise spent in monotonous repetitive work. Roy brings out the character of his workmates, and explores how he himself became engrossed in the horseplay:

So initial discouragement with the meagreness of social interaction I now recognised as due to a lack of observation. The interaction was there, in constant flow. It captured attention and held interest to make the long day pass. The twelve hours of '-click, -move die, -click, -move die' became as easy to endure as eight hours of varied activity in the oil fields or eight hours of playing the piece-work game in a machine shop. The 'beast of boredom' was gentled to the harmlessness of a kitten (Roy, 1960)

While Roy's paper does describe the work setting in detail, he does not give this detail any analytic import. The analysis comes to focus on "abstract sociological theoretical categories rather than [...] a set of activities done and reproduced by those who perform the work" (p144, Randall and Hughes, 1995) Indeed, the second half of Roy's paper discusses the previously narrated story of conflict in the machine shop in terms of the "homeostatic controls of a social system". It is not that this analysis is incorrect, but that it ignores the previously described details of work. An alternative to this might be to study the details of the work itself. Or in Roy's case — since the work was itself so monotonous — the horseplay and work interactions, rather than
making abstract observations about "a social system". Unfortunately, this is not often done. Classic studies of work concern themselves almost entirely with abstractions.

The problem with producing an analysis of the detail of work is that one needs an analytical device to make the detail of work appear interesting. Without an analytic take, one merely ends up with a chronology of work actions, and runs out of things to say very quickly. What separates a social science account from, say, a journalistic one, is the analysis. The term "analysis" is difficult to define - there are nearly as many different types of analysis as there are studies. But, with studies of work, generally there are two distinct aims. The first is to understand or explain what is being studied. So, rather than just narrate the horseplay taking place in a machine shop, an analysis would attempt to explain what part the horseplay plays in the working day, and the ways in which the different horseplay was done to relieve the boredom. The second purpose is to generalise from the existing data in some way - to not say just "this is what happened here", but "this sort of thing happens in places like this". So when producing an analysis of a work setting the aim is both to explain and understand the work and to also say something not just about the particular data being studied. As criticised above, the standard "sociology of work" way of producing an analysis is to reach to sociological concepts - class, conflict and so on. The setting is explained with the use of these concepts and the study generalises using those same concepts. It is this that the 'detail critique' is attacking.

2.2.3 Workplace studies

To see that there is an alternative way to produce an analysis of work, we must move on to ethnographic studies, and in particular those which have been produced within the field of CSCW. As mentioned above, it is these studies which have emphasised most clearly the detail critique, with an attempt to describe the details of practice involved in everyday work. These studies have come to be known as "workplace studies".

One of the earliest studies which takes on this perspective — setting the ground for much of the research in CSCW — is Suchman and Wynn's (Suchman and Wynn, 1984) paper. They make use of long sections of interview transcript with staff to look at the work done by clerical workers. These transcripts reveal the complexity involved in the different jobs. This transcript is of an interview with one staff member:

EW: Would you, did you describe the job already? Have we even gotten that far?
GS: Well, I'm in the collection department. I'm the lead collector. You've met C and B (names of co workers)
EW: Yea.
GS: Okay, they’re in my group.

And uh, there’s not much to say about it.
You just collect past due balances, and you do a lot of things that uh (pause) You do a lot of customer care, you do a lot of check refunds, and cleaning their accounts, and a lot of it is not even delinquent accounts but problem accounts. They have the money And it’s just, not the fact that you convince a customer that they owe the money, number one. Like some of these people - which, you know, is a big step right there. But then to get it through their system, you have to understand what they have to do to to get a check cut.

(transcript continues over two further pages)
(Ibid, P135)

When prompted further, GS goes on to describe — over three pages — some of the work which is involved in “collection work” — despite the claim that “there’s not much to say”. From these rich accounts of work, given by different workers, Suchman and Wynn argue:

the operational significance of a given procedure or policy on actual occasions is not self-evident, but is determined by workers with respect to the particulars of the situation at hand. Their determinations are made through inquiries for which both the social and material make-up of the office setting serve as central resources. (p152, Suchman and Wynn, 1984)

Like Zimmerman’s paper discussed above on organisational rule following, Suchman and Wynn are attempting to show the detail behind descriptions given of work which rely analytically on concepts like “rationality” or “rules”. Suchman and Wynn’s study, however, goes one step further than Zimmerman. Following rules, or achieving the procedural steps that make up a job, are characterised as a case of “solving problems”. So, as an example of getting a customer to pay an invoice on time, one staff member remarks:

So you got to sit there and think, How can I get this person to pay this invoice. It’s wrong, they got the wrong purchase order, they billed them wrong, accounts payable doesn’t want to do anything with it. So you call them back up and say, I’m not asking you to pay something that is not due. What I want you to do is pay (pause) according to your PO. Pay that invoice short, okay? Then he says, I will not pay that invoice short because I’ve had too many problems with that. Unless I get a typed invoice from you, specifically. So you sit there and think, I can’t go through the billing system, it’s too late. I can type them an invoice. Set the system going through the billing system at the same time. Co-ordinate that so when he pays the check short, there will be a balance on the account. When the credit issues through I’ll have the billing department hold that credit, deliver that credit to me, not deliver it to the customer cause the customer will wonder why am I getting the credit if they think
they’re already gonna receive a bill, right? Then I would just clean up their account later. But in the meantime...

(p136, ibid.)

The job of “getting the invoice paid” is itself a problem to be solved, and Suchman and Wynn’s paper begins to expose this work. A simple description is “opened up” to expose the work. Another example of this can be seen in a later study ("the work-oriented design project") in which Suchman was involved with Trigg and Blomberg, looking at the coding of legal documents in a large legal firm (Blomberg, Suchman et al., 1993; Blomberg, 1995). In this firm a document production centre managed the large number of legal documents which related to clients' cases. Document production required documents to be reviewed by the firm's attorney to determine which documents should be 'turned over' to the other side of a legal case. Along with this “subjective coding”, each document had to have each page individually coded, and a form completed with fields from the document such as From, To, Date and so on. As one attorney described this:

You have, you know, 300 cartons of documents and you tear through them and say, I'm going to put post-its on the ones we have to turn over. And then, ideally, you hire chimpanzees to type in From, To, Date. And then, ideally, you then have lawyers go through it again and read each document, with their brains turned on.

Using a similar device as in the earlier paper, this simple ‘form filling’ is shown to be more involved — and certainly not the sort of work which “chimpanzees” could do. Documents often have multiple dates — the date it was written, date signed, date faxed — so deciding which date to code requires some knowledge of the case. Even the notion of “a document” is not entirely straightforward. The work to be coded simply arrived in boxes of paper — the paper clips holding documents together could not be assumed to delimit documents, so work had to be done to decide what designated “the document”. So while a job might be categorised as simple “form filling” this is to gloss over the details of what are often complex tasks.

“Form filling” is a activity also discussed in a paper by Randall and Hughes (Randall and Hughes, 1995) about the branches of a British building society. Tasks such as opening a new bank account involved the completion of a number of forms on the computerised system. Since these forms often took some time to complete, staff had to balance filling in the forms there and then, and leaving it to later:

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 a communication failure and have to do it all over again ... that woman 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 statistics done. (p152, ibid.)

Since filling in a form on the computer was time consuming, staff balanced filling the forms with serving the customers waiting in a queue. By keeping note of the details, the forms would be completed later when the branch was less busy, even though this was technically a breach of procedure. So the account of a task as “filling in a form” hides much of the complexity which is involved in doing that task. Filling in a form — like any activity at work — is something that must be managed and manipulated so as to fit in with the rest of the work. A simple description of some activity which is taken for granted is shown to be 'an achievement', the activity is not as simple as its description.

**Ethnomethodology**

This notion, that something which is described in straightforward terms can be redescribed, is at the heart of the ethnomethodological concept of “accomplishment”. For while both social science and everyday descriptions of activities may “gloss” activity with a straightforward description, it is possible to go beyond this gloss and describe the activity in more depth. The “gloss” is therefore something that is actually achieved by those involved. Form filling at work, for example, while it might seem straightforward is in fact an activity which takes work in balancing the different contingencies.

This redescription of a simple activity in terms of its “accomplishment” is just one of the devices that ethnomethodology provides to those wishing to analyse activity in the workplace. Since many workplace studies have made use of these devices, it will be useful to recap briefly on the principles of ethnomethodology. Ethnomethodology is difficult to explain adequately in a necessarily brief account; more successful accounts include (Heritage, 1984) and (Sharrock and Anderson, 1986). Ethnomethodology owes its name, and its main ideas to the work of Harold Garfinkel (Garfinkel, 1967). Garfinkel argued for a radical re-conceptualisation of sociology. Sociology, he maintained, had left a vast subject unexplored. Sociology had failed to look at the methods and techniques used by everyday people in everyday life, focusing instead on mass generalisations. Garfinkel urged that the *everyday methods of members of society* should instead be the topic of study for sociology. This meant that rather than looking at how the family fits into society, for example, one would look at how individuals show themselves to ‘be in a family’. How do individuals do ‘being a family’ at some times and ‘do being an individual’ at others?
This refocus implies a new focus on the everyday concepts which sociology takes for granted. Looking at terms such as ‘male’, ethnomethodologist would ask how it is that this term comes to be decided. How is one defined as male or not male? While this may seem trivial, under investigation such terms can become ‘problematic’. Garfinkel studied “Agnes”, a transsexual who, although biologically male, had passed as a female for nearly all her adult life. The fact that Agnes had learnt how to ‘do being female’ in adult life gave her a unique perspective on how individual gender identity is constructed. Ethnomethodologists find much to disagree with in conventional sociology and the relationship with other social sciences has long been an uneasy and controversial one (Jirotka, Gilbert et al., 1992).

With work studies, ethnomethodology has come to be used as a way of analysing the details of specific work situations. For ethnomethodology is rich in devices for analysing particular work events. Rather than, say, an action at work being a case of checking that someone has done something, it can be described as an example of “orienting to colleagues' actions”. Let me give two examples from a paper by Randall and Hughes (Randall and Hughes, 1995).

One key argument that Garfinkel makes is that social scientists frequently attempt to replace indexical phenomena with objective phenomena. That is, something which makes perfect sense in the context in which it is done, is taken out of that context and an attempt made to make it "objective" - understandable without reference to its context. Sacks gives a good example of this when he discusses the use of proverbs. While proverbs are useful in everyday life, it is possible - as the sociologist George Homas did - to point out that proverbs can be contradictory: "Look before you leap", "He who hesitates is lost", and so on. But this is to miss the point - proverbs are used to make sense of things in situ. The value of a proverb is it can be "applied to something that they evince an understanding of" (p422, Sacks, 1992). To say "but proverbs, as a package, are self contradictory" is to miss the point of proverbs, to miss what they are actually used for, essentially, to treat an indexical phenomena objectively.

Randall and Hughes use this observation to criticise the use of proceduralised descriptions of work. These are formal descriptions of work processes that describe

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9Although, as Garfinkel makes clear in the chapter on Agnes, this is not to suggest that sexual identity is something which is normally built up in a "strategic" sense. Indeed, it was the very fact that Agnes's sexual identity was formed through her use of "devices" and conscious acting that caused her so much anguish. Sexual identity "normally" is something which is "seen but unnoticed" - done without explicit planning.

10Indexical here means, very roughly, "depends upon the context in which it is used to make sense". So the word "fast" in the description "He likes to drive fast" makes sense in the context of different speeds of traffic.
work in terms of a number of fixed stages. To Randall and Hughes: "the office work disappears from the descriptions" (Suchman and Wynn make a similar point). Procedural descriptions of work are an attempt to replace something indexical - work - with something objective: procedural descriptions.

Ethnomethodology has been used as an device to make an analytic point about procedural descriptions of work. The details are not compromised, but the account is not one of reportage. A second example comes from their discussion of the "customer care" work done when serving the customer:

Part of this demeanour work consists in explaining to the customers the steps as they go along, what inquiries they are making of the screen, to whom they are telephoning and so on. The cashiers' competence becomes evident in the way in which the flow of interaction is maintained, without palpable gaps, in the routines of the interactions with the customer. (p151)

Although it is not mentioned explicitly, this is an example of an ethnomethodological phenomenon known as "accountability". Actions are "accountable" in the sense that when something is done it is often done in a way which makes that action publicly understandable. So, for example, if we trip on a paving stone we might say "oops" afterwards. That "oops" signals to anyone watching that falling over was accidental, rather than the actions of a drunk or whatever.

So in discussing how the cashiers maintain their interaction with customers, the notion of accountability does analytical work in bring to attention the "making publicly understandable" features of action. In another ethnomethodologically informed ethnography, Heath and Luff (Heath and Luff, 1992) discuss how the actions of staff in a London underground control room are designed so as to be 'publicly understandable by others'. While changing the master timetable on the wall, staff would "think aloud" a description of what they were doing so making their actions publicly accountable.

Ethnomethodology allows observation of the details of work to be presented in an analytically interesting way, since behind the observations there is a framework in which observations can be rendered as sociologically meaningful. Big matters are shown to turn around small details. This does not downplay, invalidate, or doubt the careful observations made in the papers above. Ethnomethodologically informed ethnography has certainly advanced understandings of "the work of work" and the studies described above are exemplars of good research. Rather it is that ethnomethodology can be seen as a resource which has revealed a world for investigation and fashioned a lens for viewing that world in detail.
Anthropological studies

This is not to say that the only way to provide an analysis of the details of work is through ethnomethodology. Some research has taken a more anthropological direction, focused less on the need for analysis, and attempted to produce an understanding of work through the examination of its details. This can be seen in the work of Harper and the work of Orr. Harper’s study discusses how economists at the IMF produced reports on countries, and how at a later date they would consider and pass on those reports (Harper and Sellen, 1995; Harper, 1998). He explains that reports with a high degree of judgement involved in their production would be “talked over” when they were passed on to other economists. That way the author could highlight sections which involved estimates or were potentially incorrect. Describing in detail the work around documents at the IMF, Harper brings out an analytic account by describing the collaboration that the document enables. The notion of a 'document' works as an analytic device in two ways. Documents act as a placeholder for collaboration between economists. The collaboration work of the economists is thus explained through the use of documents. Second, this document-centric analysis can be applied to other work situations. The study can be generalised.

One important divide between Harper's analysis and that of those using ethnomethodological devices is that the understanding of those being researched is not just in the sense of "how they do this job". One gains more of an understanding of what it is like to do the job. Harper retains some of the Chicago school ethos, in that the ethnography imparts some of the “experiential verisimilitude” of what it is like to do a particular job. This is something which often seems to be lost in ethnomethodological analysis. In the later, one gains a detailed description of how a particular job is done, but very little about what it feels like to do the job.

This can also be seen in Orr's study of photocopy engineers (Orr, 1996). The everyday problems of managing the repair of photocopiers is told in fascinating detail, along with the strategies which are used to deal with their troublesome machines. It is the narration of stories by the repair staff, and how these transmit important information regarding repairs, which feature in Orr's account. Orr shows how storytelling by the repair people threads a number of different tasks together. The stories do the work of co-operating on different machines, relaying information about problems with models of machines, training and even establishing the different levels

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11For example, Hughes (Hughes, 1958) and although perhaps not strictly Chicago school, Dalton (Dalton, 1959).
of skill of different workers. Orr's analysis pivots on the stories of the different engineers as he shows the importance of storytelling in getting complex work done.

If that was all that Orr's account did, it would be a good ethnography. But Orr goes on to describe what is like to be a photocopy engineer in such a way that one gets a real feeling for the life of engineers. He uses phrases such as "figuratively speaking, the technician's machines are in the hands of heathen" (p93), and talks about photocopiers as if they are "sheep in a flock". Compare this with Heath and Luff's study of the underground control room (Heath and Luff, 1992). Their account is a remarkable technical account of how the work in the control room is done, but one gets little feeling for what it is like to be in the underground control room. This is not a criticism of ethnomethodological studies, since they do not set out to impart the feeling of a setting, but instead describe what is done. This entails differences in the length of the description, time spent in the setting and so on. It does, however, show that ethnomethodological studies are not all there is to the in-depth analysis of work.

2.2.4 Critical conceptions of work

So far we have presented the detail critique of the conventional sociology of work, and discussed how this has motivated the workplace studies movement, and studies of the details of work settings. It would be wrong to claim, however, that workplace studies have had anything more than a marginal role in the current mainstream sociology of work. Even in a relatively progressive text on the subject, such as Grint's review (Grint, 1991), there is a lack of description of anyone doing anything. The topics discussed are race, ethnicity, patriarchy, trade unions, class, industrial conflict, organisational cultures and modern capitalism. There is no room for even a brief discussion on how work as an activity is organised.

However, the sociology of work takes on an important issue that the workplace studies described so far ignore. This is the question of structural inequalities at work, taking a critical stance towards current work organisation. A good example of this can be seen in (Kraft, 1987) in his discussion of the deskilling of programming. Kraft argues that programming is undergoing a separation of conception and execution: a division of labour into its skilled and unskilled components. Kraft shows how this division also has a gendered component, in that: "on average, the lowest paid male supervisor makes more than the highest paid female executive" (p105). These arguments are derived from labour process theory, which proposes that capitalism implies the general deskilling of work and the worsening of working life (Greenbaum, 1988).
While Kraft's study professes a concern for skill, nowhere in the paper do we have an actual description of the skill that is supposedly being lost. Nor do we hear from the programmers or even those who are cynically manipulating them for profit. While this is lost, there is a deep concern for the economic positions of those being studied. So the question is, can we take a critical stance while still paying attention to the details of work organisation? For example, studies of technology often make use of the term "knowledge worker". Suchman forcefully critiques this in (Blomberg, 1995):

A powerful construct in the political economy of work and technology development is the distinction between so-called 'routine' and 'knowledge' work. The standard organisational icon of the pyramid, for example, is stratified according to the attribution of progressively more knowledge as one moves from bottom to top... With respect to technology development this image argues that efforts to replace labour by capital should begin with displacement of routine work by automation, or of the bottom layer, by the machine. As this logic is brought to bear on increasingly more powerful organisational actors, more effective forms of resistance arise. Limits are set, hard work is preserved, technology is reconstructed from an alternative to one's labour, to one's 'intelligent assistant.'” (p91, ibid)

Suchman, among others, has revealed the skill and intelligence involved in what is conventionally termed 'routine' work (Suchman and Wynn, 1984; Suchman and Jordan, 1988) and here she makes use of those observations to fashion a politically aware critique. Having looking at the detail of the work of the "unskilled", Suchman can argue that the term 'knowledge work' is part of a more general social and economic movement. Through being aware of this point, care can be taken in using terms such as "knowledge worker". Kidd's otherwise excellent study of office work, for example, makes use of the term with little awareness that it could be contentious (Kidd, 1994). The point is that when conducting an detailed study of work one must still be aware of the politics of work.

An alternative approach is to study the politics of the workplace and remained open to the details of work. Another study in which Kraft was involved in a good example of this (Klein, 1994). TQM (Total Quality Management) is a popular management technique based on several innovations to conventional mass production: organisations, rather than producing more products, should instead focus on producing products better and faster.

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12Although this paper has Blomberg as first author, it is divided into three different "voices" written by different authors.
Klein and Kraft describe the implementation of TQM in two organisations in the United States. TQM was presented as a technology which would create better work for both employee and worker. This is empowerment, "the creation of social conditions which are conductive for realising human potential, in particular intellectual and social capacities" (p107, ibid.). But the effects of TQM are not that straightforward. While responsibility is delegated to previously 'powerless' employees, the form of that empowerment is strictly limited. A situation is described where "the [employees] were 'empowered' only to make suggestions. Managers, in short, constructed teams according to the nature of the productivity gains to be made, not according to some abstract commitment to empower all workers." While the workers "won" because they no longer had the foreman breathing down their neck, this was replaced to a certain extent by self exploitation:

Consider the following: one PA, whose work involved lifting components onto benches for inspection, had developed a severe repetitive motion injury. She reported working an average of sixty-eight hours per week during the previous year. She did not attribute her injury to the shortage of workers on the team - a condition completely under the control of the site manager - and the consequent need for continuous overtime. Instead, she praised the company physician for urging her to work fewer hours. She blamed herself for injury, saying that it was 'in my nature to work hard in order to get a job done. That's just me.'" (p105, ibid.)

While Klein and Kraft's study sets out with an implicit political motivation to investigate the effects of TQM on the social control of workers, they do this in a way which is aware of the details of particular working situations. They do not impose sociological concepts onto their data in an unreflective way. A second point which this study demonstrates is how politics can be seen in the practical day to day concerns of those involved. The fact that TQM "empowers" staff in a narrow way is seen through their descriptions of the workplace, not a blanket assertion13. What Klein and Kraft go some way to showing is how politics can be seen as a practical concern of those in the workplace in a day-to-day sense. For a fact often glossed in studies of work is that political concerns are an ongoing concern for workers. Politics is not merely an abstract sociological concept but one which is of ongoing importance to those doing the work. This point is discussed in more depth in section 6.3.3.

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13This can be compared with the critiques of Business Process Re-engineering (a technique similar to TQM) where criticism is made without reference to any actual projects (see particularly (Grint, Case et al., 1995; Willmott and Wray-Bliss, 1995)).
2.2.5 The history of work

Another aspect of the workplace which is left out from workplace studies is its history. This is perhaps an inevitable consequence of the methodology of workplace studies and the difficulties of conducting a longitudinal study. However, to understand the current state of the workplace it is rewarding to consider its historical development.

The taken for granted features of work organisation can be seen developing before the turn of the century in American business. The formal division of labour, for example, developed last century. Chandler locates its development in the attempts of American railroad companies in the 1850s to run their rapidly expanding lines. Before 1850, lines were run by a small staff with one supervisor, all working out of the same office. As the lines grew to a length demanding different offices and multiple sections, the inadequacies of this organisation became clear, particularly after 5th October 5 1841 when two passenger trains on the Western line collided head on. A legislature report recommended:

Definite responsibilities for each phase of the company's business, drawing solid lines of authority and communication for the railroad administration, maintenance and operation (quoted p97, Chandler, 1977)

The recommended form of organisation quickly spread to other railroad companies and by the time of the civil war, the needs of first safety, then efficiency, were such as to create the basic form of the modern business enterprise. Management was arranged in a hierarchy, with duties carefully defined in organisational manuals. By the turn of the century, the production of products such as tobacco and meat were also being organised with complex distributed structures, along with centralised middle and upper management co-ordinating the production and distribution of products:

On account of their perishability the handling of fresh meat is a peculiarly delicate business. The packer aims to get as high a price as possible, but he must sell the entire product before it spoils. Differences in quality of animals and of their products are so great that the closest supervision of the central office is necessary to enforce the exercise of skill and sound judgement on the part of agents who buy stock and the agents who sell meats. With this object, those branches of the selling and accounting department of the packing companies which have charge of the purchasing, killing, dressing, and selling of fresh meats are organised in a more extensive and thorough manner. The central office is in constant telegraphic correspondence with the distribution houses with a view to adjusting the supply of meat and prices as close as possible to demand (Bureau of corporations, report of the commissioner of corporations on the beef industry, Washington, March 3, 1905 quoted in p396, ibid.)
This division of labour, however, with a hierarchy of staff, then supervisors, then managers, was only feasible with improvements in communication. Lines of command required lines of communication. On the Baltimore and Ohio railway line regular reports had been developed along with the managerial hierarchy as a powerful means of control:

Daily reports, the real basis of the system, were required from conductors, agents, and engineers. These were then consolidated into monthly statements. Reports on each locomotive, for example, included miles run, operating expenses, cost of repairs, and work done. Such data, flowing regularly from the division superintendents ... essential for regular and economic flow of trains and traffic, also made possible the comparison of work of the several operating units with one another and with those of other railroads (p103, *ibid.*)

This form of control - through communication, and in particular regular formalised communication - was another step towards the modern organisation. At the same time, technology advanced to support this communication. As Yates puts it: "an insatiable desire for efficiency created an office revolution since unequalled until the advent of the desktop computer" (p97, Yates, 1989). Yates' study discusses humble technologies such as the typewriter, carbon paper and the vertical filing cabinet which made possible a huge increase in written communication, and its efficient storage and duplication. This was at the heart of the "systematic management" movement, an attempt to

eliminate confusion, oversight and neglect; co-ordinate efforts, return firm control to the top people in the organisation, accomplish these things through the use of standardised procedures on routing managerial work through 'Method' or 'System' (Litterer, 1961)

That is, standardised flows of written information up and down a fixed hierarchy. With growing organisations producing increasing amounts of information flowing up the hierarchy, the information came to be used as much for a record as for a form of communication. By providing records of past communication, information could be held independently of the individuals concerned. Moreover, records served a political purpose - different departments and individuals wanted to document their side of the communication for later reference in potential disputes. Written communication allowed orders to transcend an individual's memory and, to an extent, arguments over the specific terms of an instruction. A second innovation which the written record allowed was the standardised form:

In a period during which "system" was the universal catchword, forms filled an important role in systematising certain types of downward communication. They conveyed, as economically as possible, specific
instructions that would otherwise have been conveyed orally (thus leaving no record) or in an individually composed note (thus taking more time). They were simultaneously mass communication and individual communication (p74, Yates, 1989)

Forms simplified the job of both the reader and the composer. Instead of writing prose or working out what information was needed, a form user only needed to fill in the blanks. For the reader of the form many different forms could easily be compared because the same information would be in the same place on each completed form. The form standardised and controlled the communication, without the intervention of any individual. It was if the form itself constrained action. Weber wrote "the combination of written documents and a continuous organisation of official functions constitutes the 'office' which is the central focus of modern corporate action" (Weber, 1971). Measures such as formal communication, reports and hierarchy are all devices which seek to organise and produce order from what may otherwise be ad hoc.

Yates and Chandler write as business historians, uncovering a chronology of the development of organisations. They turn the ordinary organisation of work into something analytically interesting by using the viewpoint of history. Through showing very ordinary devices such as the typewriter in development, the ordinary is made strange. Take, for example, Chandler's discussion of train timetables. The fact that a train company would not allow train times to be changed unless they had first been changed in the timetable is perhaps not itself an analytically interesting fact. It is, after all, a mundane point about the organisation of a train company. In Chandler's history, however, this fact comes to life in the terms of the historical development of organisations. This restriction shows the formalisation of communication, the move towards the written over the oral and the centralisation of control in the hands of whoever changes the timetable.

While the studies are valuable they lack the details of the day to day way in which these organisational devices were used, managed, developed and so on. History can only give us a view through those records which survive, accounts of participants, surviving documentation and so on. We miss out on the "lived work" involved in making these devices work. Yates, for example, describes the development of the standardised form with an example of a completed form from Industrial Management Magazine, circa 1917. The form, however, contains a number of blank fields and, it appears, some subversion of the instructions given on the form for its completion. This raises questions about how the forms were used in practice. When would a form be subverted, and when not? The details of practice cannot be uncovered from Yates' description since it is given at the level of history, not individual's actions. This is the advantage of the workplace study, Randall's discussion of form filling in a building
study showed the lived work of completing a form in more detail than a historical study could ever do. However, historical studies do provide an interesting background to the study of the modern organisation.

2.2.6 Summary

This section has covered a number of studies which have looked at work. A common argument is that the sociology of work has failed to study its subject matter in sufficient detail. This is the "detail critique"; that attention has focused on the level of analytical constructs, rather than on the different ways in which work itself is organised. While a relevant criticism, reflecting on some classic studies of work and bureaucracy, show that it is not that the work is not described, but rather that it is not thought to be analytically interesting. This led us on to workplace studies which have studied work practice through the use of ethnography. Here an analytic device can be seen in the use of ethnomethodology. Ethnomethodology provides an approach which can be used to make a study of work practice analytically interesting while remaining close to the details of work. Alternatively, other studies have taken more of an anthropological direction, seeking an understanding of the work environment. In addition to workplace studies, two other approaches to work were discussed. Firstly, there is the study of the political nature of work, which was discussed using papers by Klein and Kraft. While not advocating the macro-level analysis so loved by the sociology of work, it was noted that it is important to be aware of politics as a living concern for those doing the work. Secondly, historical approaches and particularly the work of Yates and Chandler were described. These provide us with a historical viewpoint with which to understand the development of the modern workplace.

2.3 Studies of Lotus Notes

Having discussed studies of work it is now time to jump back into the specifics of this report's topic. A number of studies of Lotus Notes have been conducted since its release, along with an avalanche of books which discuss the technical side of using Notes (Press, 1992; Pyle, 1993; Bates and Allen, 1994; Hawkins, 1995; Kraut, 1995; Strehlo, 1995; Lotus Development Corporation, 1996). In general, however, there has been little in-depth analysis of the 'real world' use of Notes. This lack of studies is discussed by (Plowman, Rogers et al., 1995):

There have been far fewer studies of the procurement, implementation and use of CSCW systems in places of actual work than studies intended to inform either CSCW in general or the design of specific systems. One reason for this imbalance is that groupware and multi-user systems for office support have only recently become widely commercially available. Another reason is that the focus of research has primarily been understanding the nature and requirements of existing co-operative work
and communicating practices for the purposes of informing the design of future systems. The need to inform the design and redesign of systems through evaluating the implementation of CSCW systems in actual work settings has only recently been acknowledged. (p316-317, Plowman, Rogers et al., 1995)

Those studies which have been conducted divide into two main groups. Studies pre-1994 tend to focus on the failure of Notes in organisations. The most popular example of this is the heavily cited Orlikowski paper (Orlikowski, 1992). This was a part of a general consensus amongst CSCW researchers that computer support for collaboration had generally been a failure. Since then a number of more positive studies have been published (Grudin and Palen, 1995; Turrell, 1995; Bikson and Eveland, 1996; Lloyd and Whitehead, 1996; Olson and Teasley, 1996; Hepso, 1997; Orlikowski, 1997), yet with one notable exception all these studies have lacked any real depth in their study of use.

2.3.1 Notes take one: problems with implementation

The first study to bring Lotus Notes to the attention of the CSCW community was Orlikowski’s 1992 study (Orlikowski, 1992). This short paper describes the unsuccessful attempts to implement the use of Notes in a large international consultancy firm. Orlikowski lists a number of reasons given by the employees why Notes was not used. In this, the paper follows on from (Grudin, 1989), an influential paper which listed the potential reasons why groupware implementations fail. The reasons Orlikowski gives for the failure of Notes fit neatly into Grudin's categorisations. Figure 2.1 (page 43)\textsuperscript{14} shows this by categorising Orlikowski's observations by the more general reasons for groupware failure given by Grudin (justifications for the categorisation is given in italics).

While Orlikowski's paper neatly demonstrates the problems which Grudin's identified, we never hear of anyone actually using Notes. Notes is merely deployed and we have quotes of employees explaining why they do not want to use it. Moreover, the analysis in the paper is extremely brief, despite the large number of interviews (91) on which it is based. One worrying point is that the study ended only four months after use started. Since we never hear of any Notes applications which were used by the consultants, it is possible that the employees were interviewed before any Notes applications had been developed. A promised follow up paper on the employees was never published.

\textsuperscript{14}Figures are at the end of each chapter.
Despite these problems, this paper has been referred to numerous times as an example of 'the failure of groupware' (for example, (Heath, Luff et al., 1995) or (Harper, 1995)). The story of groupware's failure seems a useful device on which to argue for the necessity of academic studies of groupware.

2.3.2 Notes take two: Commercial success

More recent papers by the same authors (Grudin and Palen, 1995; Orlikowski, 1997) are more optimistic about the chances of groupware's success. The paper by Grudin and Palen describes two situations in which shared electronic dairies became widely used whereas Orlikowski's second paper discusses the use of Notes by a customer support department in the Zeta Corporation (we will discuss this paper later in this chapter).

Along with this work, Notes has had increasing coverage from a practitioner's perspective. Lloyd and Whitehead's (Lloyd and Whitehead, 1996) edited collection is the best of these, a matter of fact discussion of 24 case studies of organisations which have implemented Notes together with their experiences. While it is a good collection of case studies, for the purposes of an in-depth study of Notes, two criticisms can be made of this book. First, and this is a common problem with 'popular' books on technology, is that the pages seem to be full of rhetoric in favour of the technology, rather than discussions of its use. At times the case studies seem to get dewy eyed about Lotus Notes. There is a continual focus on rather hazy notions of "knowledge", "information", "sharing". One chapter, for example is titled "From Information to Imagination". In the preface Clary writes:

> Note has been heralded as a breakthrough software product [...] until recently there has been little technology available to enable the efficient and effective sharing of a vast array of business information across organisations (Lloyd and Whitehead, 1996, page vii)

Simply put, there is a lack of any sort of critical stance on the technology. Instead, the stance seems to be one of encouraging managers that it is a "good thing". Perhaps with a book aimed at IS managers this is to be expected, although we should not forget that this is a discourse often used to promote technology over other investments and as such is a political statement. (Kling and Iacono, 1988) discusses the ability of technocrats to build support behind investing in technology over other, potentially more valuable, investments.

The second criticism (familiar from the last section) is made by Harper in his review of the book (Harper, 1998):
What researchers in CSCW are after, to paraphrase Dave Randall and the Lancastrians, is detailed examples of how Notes gets introduced into a particular setting. The interest is in how general organisational processes supported by some technology get used in specific work practices. [...] Here, as I say, there is simply not enough detail in the book. (p96, ibid.)

So while the book offers us warm words about Lotus Notes, we get no closer to a description of how it is that particular Lotus Notes applications are used. Of course, the book is not presented as an in-depth analysis of Notes, so it is unfair to criticise it in this way. But we are still left wondering what actually is done with Notes. The details of how Notes is used are not considered to be analytically interesting, much to the loss of understanding the technology. It is at this point that the detail critique makes an appearance with regard to Lotus Notes. What is actually done with Lotus Notes? Where are the indepth descriptions? Other research into Notes also suffers from a similar problem (Bikson and Eveland, 1996; Olson and Teasley, 1996; Hepso, 1997; Lai and Turban, 1997), as does research on Computer Mediated Communication (El-Shinnawy and Markus, 1997).

2.3.3 Orlikowski's second study

There has been one study which has looked at the use of Notes in depth, Orlikowski's second Notes study (Orlikowski, 1997). This paper is worth discussing in some detail as it describes how the staff came to integrate Notes into how they did their job. While her first paper was fairly short, her later paper is considerably more detailed. Although based on half the number of interviews there is more detail, and it paints a more optimistic view the use of Notes.

The customer support group at "Zeta" dealt with clients problems with the software products produced by the company, using Lotus Notes to manage their technical support. Lotus Notes was not the first database to be used by the customer support department. Previously single user and batch entry databases had been tried. Before that "everyone had a stack of papers on their desk". The effects Notes had on the work were both planned and unplanned, but an evolutionary approach was taken to these developments and the work practices flexibly rearranged to fit the changing nature of the job.

One of the first changes involved alterations to how solutions were tracked. Previously technical support consisted of answering queries through books, memory and experimenting with the supported software. After Notes was implemented each call and every solution to that call had to be fully documented and entered into the Notes database. A large part of the specialists' job became describing the details of each call sufficiently so that the call could be easily passed on to another specialist.
As the database grew in size with records of old solutions it became more and more useful as a source of information for solving problems, with one specialist estimating that as many as 75% of calls were answered using the database. With the database publicly available and regularly used it seems that the motivation to use the system came partially from peer pressure and partially from work with the database being established as ‘part of the job’.

Notes had become part of the working norms of the specialists. While the system was used, the specialists still encountered a number of difficulties. A large part of writing the entries appeared to be the de-contextualising of the information being entered. Since the information in the database was going to be shared and read without the author being present, the specialists had to make it understandable outwith the context in which it was written. A second interesting feature is that the specialists saw this process as different from that of explaining themselves verbally in conversation. Presumably, in conversation mutual understanding can be built gradually through questioning and explanation. There were other interesting issues concerning the presentation of self in the database:

The accessibility of the database is something that I’m always aware of and I think I’m very guarded in what I put into the database. ... I am always concerned about being politically correct, professional, diplomatic [...] I’m always very careful about how I will word a response or even a question from a client, even an internal person... I know it’s very easy to sit there and really put in some sarcastic comments about the person and in a way it kind of makes you feel better to do that, but I’ve always not done that specifically for the reason that a year or even six months from now that person may see that incident and take offence and it could jeopardise future relations

(p7, quotations from interview data)

It appears the specialists put considerable time into presenting themselves as professional and responsible. Indeed, this appeared to be a strong incentive for individuals to enter data into the database. Since it was possible to access who had written what, there was considerable peer pressure to be seen to have done your job. Moreover, specialists would rate each other, trusting information from people whom they had “gotten good information from in the past”. Trainee specialists were advised to get a number of solutions from the Notes database, contrasting competing solutions before deciding which one to use. This then became the suggested solution and if it solved the problem it became fixed as “the solution to the problem” by being entered into the database. Indeed, after a solution has entered the database some employees talked of the danger of it becoming too heavily relied on, rather like a bad scientist
relying too heavily on existing results. The more junior consultants were advised to experiment rather than just take replies from the database.

The 'opening up' of the work by it becoming displayed in the database was obviously a problem for some specialists. Management took advantage of it to increase their control of some aspects of the work. In Orlikowski's quotations, the specialists tended to explain their fears of management supervision as a personal problem, rather than blaming the management:

I know that managers look in on our calls, because I have gotten comments back about having to qualify certain pieces of a call or provide further status... when I've been very busy and under a lot of pressure, the first thing that comes to my mind is, “God I just wish they'd stop” but when I have time to go home and think about it and relax I can understand what they're doing and why they're doing it.

(p10, quotation from interview data)

One specialist worried about the managers “micromanaging the volume”, that is, managing and arranging his work day at a fine level of detail. From the quotes there is a sense in which one detects that management are viewed as “just doing their job”, even if that job involves continual surveillance.

Unfortunately Orlikowski's treatment of these issues is minimal. Although we have a fascinating picture of the changing work, the political and control aspects of the database are not examined. Moreover, we have no explanation of why Notes failed with the consultants, yet succeeded with the specialists. Nevertheless, Orlikowski's study is revealing about how Notes comes to be integrated into the workplace and the issues this provokes. It also takes account of the detail critique, in that it describes in detail how Notes became integrated into the work.

Orlikowski's study provides an opportunity for more investigation of Notes since she only looks at one application, and one particular job. We do not get any sense that Notes influenced the organisation as a whole, nor do we hear about other applications for which Notes has been used. This gives scope for a wider study of Notes, to look at other applications and how Notes is used more generally. In doing so, we can also consider the political aspects of Notes which Orlikowski only briefly touches on, while remaining attentive to the details of the work.

2.4 Conclusion

This chapter has critically reviewed studies of both work and studies of Lotus Notes. With regard to the studies of work, the detail critique has maintained that work has been described in insufficient detail, its details glossed and removed with an analysis which takes place at the level of abstract variables. This led to some authors
attempting more in-depth studies of work, the so called "workplace studies". A number of these studies were ethnomethodologically informed, or made use of devices from ethnomethodology. As mentioned in the introduction, this study is not an ethnomethodological one, in that its focus is broader and its relationship to historical analysis and the political world of organisations makes it distinct from traditional ethnomethodological studies. Conducting ethnomethodological studies involves a number of commitments which would not be possible in a practical study such as this. For example, Garfinkel argues that the analyst should not present judgements as sociology. It is not the analysts' place to make 'sociological judgements' but rather to understand how those arguments are made (Garfinkel, 1967). This is not to say that the observations of ethnomethodology will not be used, but they inform rather than dictate. For example, the notion of "achievement" is used throughout this study, as it nicely summarises how something which can be described in straightforward terms can be described in more detail.

Two criticisms of workplace studies were made. One is that they tend towards political neutrality, since they do not take seriously political disputes in the workplace. That is to say, the focus on details means that they neglect a more structural description of work. This was one failing of Orlikowski's study discussed earlier. A study should be sensitive to the political implications of what is being studied (see section 6.3.3 for an example of this). A second criticism is that workplace studies do not often consider the development of the situation which they are studying. Considering the work of Chandler and Yates as business historians went some way to illuminate this. The discussion then moved onto studies which have looked at the use of Lotus Notes. A shallowness in analysis was mentioned, and in particular Harper's call for investigation of how "detailed examples of how Notes gets introduced into a particular setting". This call reveals an area in need of investigation, the question of what is actually done with collaborative technology at work. What is it actually used for? This is the research question that will be addressed in the rest of this report.

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15 For example, it is not the place of sociologists (or philosophers) to judge scientific knowledge claims somehow 'inadequate' for sociological reasons. This would be to obscuring the sense in which scientific knowledge claims are products of science, not philosophy (Lynch, 1992).
<table>
<thead>
<tr>
<th>Reasons why groupware applications fail</th>
<th>Learning from Notes</th>
</tr>
</thead>
</table>
| Poor intuitions about groupware         | • Inappropriate Training  
  *Employees couldn't grasp what Notes was*  
• No Motivation to do training  
  *Employees had low motivation to understand Notes*  
• Top down installation  
  *Use was management rather than peer encouraged*  
• Employees worried about database information being mis-interpreted  
  *No intuition about the status of 'shared information' inside databases* |
| Violated Social Taboos                 | • Worries about security  
  *Security was a 'norm' which has to be shown to be respected - Notes was not demonstrably secure* |
| Threatened existing power distributions | • Client lists were employees' power bases so they didn't want to share them with others |
| Disparity in Benefit                   | • Individuals got no benefit from sharing information, only risks if information was misinterpreted  
  *Employees worried about information being shared and mis-interpreted.* |

Figure 2.1 Comparison of reasons for groupware failure
Chapter Three: Notes in use

An introduction to Lotus Notes and how it is used in organisations
3.1 Introduction

Although the design of Notes is relatively straightforward, its unique nature means that it is not easily categorisable. As mentioned in the first chapter, this has led to some confusion about what Notes is actually used for. Some describe Notes as a database, others as a groupware system, or even as an advanced Email system.

For this study, interviews were conducted in twenty four different companies using, or about to use, Notes. Three of these organisations were studied in-depth. Amongst these organisations there was something of a divide in their attitudes towards Notes. Some companies saw Notes as 'just another development tool', to be used alongside other tools when appropriate. This was accompanied by a hesitancy in installing Notes on machines, a hesitancy which in turn limited the number of applications which Notes could be used for. In other organisations, Notes had a more dramatic impact. Notes was not seen as just another database system, but as an *infrastructure* for the local development of software. Notes would be installed on every computer and the development of new databases in Notes a usual occurrence.

Narajo\textsuperscript{16} Oil was one of the later companies. There, staff were heavily committed to using Notes to the point that when I first visited the company I was told that it was essential for the company's business. I had access to Narajo as a participant observer, and studied it in-depth over a period of three months, obtaining the majority of the data for this thesis. As a participant observer, I worked in the Information Systems (IS) department collecting data on how Notes was used within the department to help with their day to day activities. Along with this I undertook twenty one tape recorded interviews with members of staff picked from throughout the company.

To most users 'using Notes' means making use of a Notes database which has been programmed by someone else. In common with all computer programs, these databases must be designed and developed before they can be used. This development is, for the most part, a separate job from their use (although see section 4.3). So as to be able to study both sides of Notes I worked on the development of a Notes database, the 'timewriting system', while I was at Narajo. This gave me an opportunities to study both the *day-to-day use* of Notes and the *development of software* using Notes. The next chapter discusses the development of software in Notes, whereas this chapter focuses on the day to day use of databases, using both observations from Narajo and interviews with company staff.

\textsuperscript{16} Narajo Oil is not the name of the company studied. Pseudonyms have been used for all the companies and individuals referred to in this study.
Section 3.4.3 starts the fieldwork discussion by describing the different types of Notes databases that were used at Narajo. Four types of database are discussed: Electronic Mail, public forums, workflow and tracking databases. This gives a view on the different tasks Notes was designed to support. But while this discussion gives us a preliminary view on Notes, it is based around how the technology is designed, rather than how it is actually used. The concern for studying use voiced in chapter one moves us on to look more closely at how Notes was *appropriated* by staff. Notes use involved different ways of incorporating Notes to help get the job done. This is discussed in terms of how Notes was used as different 'devices'. This gives us 'ordering devices', 'symbolic devices', 'interactional devices' and 'political devices'. These devices indicate that while technology may be designed one way, how that technology is woven into the working world is a separate question.

Lastly, there is a short detour from Notes to investigate how other technologies were used as 'devices'. This brings out the fact that there can be similarities in the use of technology, even though the technology itself may be quite different. Spreadsheets and telephones are described as "ordering devices", and "interactional devices", just as Notes was. This brief discussion demonstrates that other technology can be used in interesting ways not determined just by their design.

### 3.2 Understanding the technology

Notes is something of an enigma in the computing world. Not immediately understandable in the terms of the usual computer applications, and with a reputation as being difficult to implement, its popularity has been limited to a small - but growing - number of mainly large organisations (Lloyd and Whitehead, 1996). The advertising for Notes has contributed to this, with a suggestion of Notes as "radical" for organisations, "organisation-ware" and other, somewhat opaque, statements. Notes, unlike other computer applications, is billed not as a technology for improving information systems, or doing individual work tasks, but from the first as a *managerial* technology which changes the social environment in which it is placed. It is, to quote one particularly hyperbolic discussion, "an agent of change" (McCready and Palermo, 1994). This unusual status has both helped and hindered its acceptance, with it being ignored by some companies and advocated with an almost evangelical zeal by others. Lotus Notes itself is relatively simple to explain. Confusion arises, however, because while it has similarities with many other applications, it has its own distinct design. There are similarities between Notes and email systems, databases and spreadsheets. Despite this, Notes is sufficiently diverse as to be worthy of consideration as an application unto itself.
Perhaps the closest application to Notes in terms of design is the database systems. Databases are computer systems used to store information in a standardised form so it can be accessed later. For most readers, this concept will need no introduction, since access to information stored in computer databases is increasingly common. Library computers, for example, keep the details of all the books and book loans in databases, as do banks with bank account details, and shops with details of their stock. Databases are traditionally very large applications, used to store vast amounts of data. Their size, and their value to business, makes them important applications. On the other hand, Notes is designed for much smaller applications, with less than a few thousand records. Its design is more flexible and far less constrained that larger database systems. While this sort of flexibility makes Notes more adaptable, it makes it less appropriate for storing large amounts of data. Flexibility may be desirable for an address book, but not for bank account details.

For it to be worthwhile to develop Notes databases for these smaller applications, development has to a relatively simple task. For this purpose, Notes has a basic programming language, comparable with that used in spreadsheets (such as Microsoft Excel). This makes developing in Notes quicker than with traditional database products. Although its interface has become more complex in recent versions, the design of Notes is still based around a few key concepts.

When each individual user logs onto Notes they are presented with their own personal collection of 'boxes' (known as 'icons', shown in figure 3.1, page 76) which are linked to Notes databases. Inside each database are documents where all the useful information is held. These documents are all based on forms which are pages of text and graphics with spaces left blank. These blanks are called fields. Documents are simply forms with these blanks filled in. Since these blanks can be any size and can contain attached documents or files, this simple design is quite flexible.

To get an overview of each database there are views which, as their name suggests, are ways of viewing a summary of the documents held in each database. A view lists each document on one line, vertically down the screen. Across the screen there are columns which display a bit of information about each document. So, for example, in a telephone database the two columns might display the name taken from the "name" field in each document, and the telephone number taken from the "telephone number" field in each document. When one enters a database, one is taken immediately to a view, from which it is possible to click on documents to see or edit them (figure 3.2, page 77).

Documents can also have buttons in them which, when clicked, run programmes written in the Notes programming language. This means that documents can have
buttons that when clicked mail themselves to everyone in a certain department, or
indeed anything else Notes can do. This functionality is integrated with the electronic
mail system built into Notes - every person who uses Notes has a database which is
their 'mailbox' and is used just like any other electronic mail system. Since this is
built into Notes, databases often automatically send mail messages, informing people
of events, asking them to edit specific documents or whatever.

This is made clearer by looking at an actual example. When a user first enters Notes
they are presented with something like figure 3.1 (page 76). Each box is connected to
a different database. Double clicking on the "Low Value Orders" box would take the
user to figure 3.3 (page 78). This is a database view, each line representing one
document. Databases can have more than one view, with different views showing
different documents and different information from those documents. The list of
views is shown on the left hand side, marked with small magnifying glasses. Creating
a new document is shown in figure 3.4 (page 79). This is a standard form with blanks
indicating where to fill in the details for this document. At the bottom of the
document (figure 3.5, page 80) is a button ('Fax Now') and if the user pushes that
button the document is automatically faxed to the supplier specified. Since each
Notes database is designed with different forms, views and buttons, each database
works in different ways. Notes is thus an environment for developing and running
different applications - all of them based around this simple model.

Notes is most commonly described as 'groupware' or 'collaborative software' (Lou,
1994) because the databases can be stored on a central server computer and accessed
from individual client PCs. This means databases are naturally shared, since they can
be accessed by more than one PC at any given time. This makes Notes databases
ideal for sharing information between different people, giving it the status of a
collaborative application.

3.3 Notes in use: The general picture

Before conducting the participant observation at Narajo, twenty four informal
interviews were undertaken with organisations which used Notes. These interviews
were primarily used to obtain access for the study proper, but they also provided an
insight into the use of Notes in different organisations. The organisations which were
investigated can be divided into two categories. Some organisations were completely
sold on Notes and had it installed on everyone’s - or nearly everyone’s - machine.

17The organisations were selected from members of the Lotus Notes user group in alphabetical order. Only two
organisations refused to take part.
Other users were more cautious, having a handful of successful databases, with Notes only installed on the PCs of the people using those applications. Unlike other applications, Notes relies to an extent on everyone having it on their computer. It is not possible to have public, company wide applications if only a small minority of the company have access to them. This makes Notes something of an “all or nothing” technology, much like other groupware systems (Grudin, 1989).

Those companies with only a small number of applications tended to see Notes as a database development tool, to be used along with other tools when appropriate. From my notes of one interview:

X discussed "Approach" a PC database made by Lotus and compared it briefly with Notes. Thought Notes could be viewed as "just another PC database" rather than something different.

(ttlab/AE)

In companies with Notes only selectively installed, developing and rolling out a database is going to be difficult, since they have to negotiate the purchase and installation of Notes on all the user's machines. This limits its use to large applications where the cost of installing Notes can be justified:

B: Do you still use paper forms?
A: Forms - yes indeed! [We] can't use workflows that much because we don't have everyone on Notes

(ung/N)

This hesitation in installing Notes is perhaps understandable. Until recently Notes was an expensive application, with an individual 'licence' having to be bought for each user. This made getting management support for Notes an essential part of installing it, since this was the only way that backing could be found to pay for the cost of the user licences. From the histories described in the interviews, this can be a difficult process. Getting a company to commit to using an application like Notes, and paying money to have it installed on each machine, involves considerable coalition building and political manoeuvring. One writer on the implementation of Notes describes a process called “Backdoor Deployment”:

18These codes refer to pages of my field notes or interview data. Field Notes are marked with a date, or a description if no date was available. Interviews from Narajo were coded 11-139. Interviews with other companies are coded by code for the company/Initials of interviewee. When something is quoted verbatim I have surrounded it in quotation marks (" ... "), or presented it as a dialogue. Extracts from field notes are presented without any surrounding punctuation.

19Expensive is a very relative term but before 1995 Notes cost around £300 per user.
In companies where the IT group resists Notes it is necessary to use more underhand methods of implementing the technology. Sometimes Notes can be slipped in as part of a wider solution which allows it to ride on the coat tails of a more popular application. (Turrell, 1995)

Interviewees often told me about their “plans” on how to get Notes introduced into the company. The usual format was a story where the interviewee described discovering Notes, using it for one application and then being convinced of its potential for the whole company. This revelation then led to a description of future plans for getting it introduced:

They tried to implement an electronic fax system and because it was done by committee it took 2 years! G has a different plan for Notes - get one part raving about it and then give it to everyone else and go from there. (ers/GL)

XX Bank have stated on the road to a complete Notes install and M is "expecting a decision in six months about getting the ok from a higher level". Just now they have gone from 20 users to 200 users 'illicitly' and then M was brought in to make it more controlled. (ank/MB)

3.3.1 Mech. Corp.: A failed implementation

That the introduction of a technology like Notes to an organisation is a political process was underlined by my connection with the machinations at Mech. Corp. My original contact with Mech. Corp. was with the “new product introduction” group run by a manager, B. B had become convinced of the value of Notes through attempts to find a technology to help him run the product introduction process. Mech. Corporation made a number of large radio systems used by public utilities worldwide. Introducing these products (after they had been designed and developed) was a major process, involving co-ordination between regulatory bodies, factories, translators and salespeople to make sure that the radios successfully made it to market.

B and his staff had gone through a number of different computer programs over the years in attempts to track and make sense of this process. In Notes, B saw the tool which would solve his problems. To use Notes, however, involved giving Notes to all those involved in the process - over 100 people. B started building alliances to get support for its implementation. He made contact with S, who did a similar job in a different division of the company (although physically just round the corner). S also became convinced that Notes could help and went on to develop bigger plans for Notes:

S: There’s a very big master plan which I’m not prepared to talk to you about.
S: Five year rolling strategy plan. Now I’ve seen in and I’m working inside it. This is the essence of my initiative to drive Lotus Notes. We’re going to have to introduce at least four to five products every year.

Me: Without dying!

S: Without dying and... at a very much... Well, I want to manage the process and not be managed by the process, that’s the idea.

By borrowing machines and software, the new product introduction group slowly began to build their Notes installation. An MSc. student working in the office was given the job of designing the application, a job which both S and B became involved in. The centralised IS department had no involvement in this, being characterised by B as more of a hindrance than a help. To give Notes to all the staff needed considerable funds to buy the software and servers for all the different staff involved. Accordingly, a bid was prepared to be presented to the area manager. This bid was acknowledged by everyone involved as an explicitly political process. In the sense that allies need to be gathered, presentations made, arguments formed. These were political matters. To aid this, a third manager was convinced of the need for Notes and a second application (customer complaint tracking) added to the funding bid. The managers “wined and dined” various elements who could influence the progress of the bid.

Although the bid seemed sure of success, a sudden organisational change meant that the bid went to an unprepared manager, one who had not been smooth talked into the advantages and potential of Notes. He rejected the bid, and Notes development stalled. Other consequences of the organisational change involved layoffs of personnel, and the window of opportunity for Notes closed, as B and S started to focus more on keeping their jobs than pushing the technology. Rather than seeing this as just bad luck, the staff saw this defeat as a failed attempt to play politics. The IS department had set themselves against Notes (they instead advocated a Microsoft database product). When the new area manager asked IS about Notes, they gave the product a negative review, dooming the project. Indeed, despite attempts to convince IS otherwise, one year later the Mech. Corp. division were no closer to adopting Notes. As S put it: “The money isn’t there”.

3.3.2 Living Technology: A single application

Another company investigated was Living Technology, where six Notes users were interviewed. Living Technology, a software development house, had got further than Mech. in introducing Notes, but had instead become a single application house. Notes was used, but only for one application. This ‘call tracking application’ helped staff to give technical support to the time management products they sold. A similar
application was discussed earlier (Orlikowski, 1997), and a Notes customer survey placed these applications as the second most popular Notes application in the U.K. (Pincher, 1996).

Telephone support calls would be made to Living Technology, and logged onto the Lotus Notes system. The person who logged the call (known as “first level support”) would attempt to fix the caller's problem. If they failed, the call would be passed onto “second level support” — individuals who were expert in particular software packages. All the recording of problem details and the passing of information went on through a Notes database. With first level support distributed throughout the world Notes handled the communication with second level support based in Britain and America.

This system had been used for over three years, slowly developing over those years. To the second-level consultants whom I interviewed, their job consisted of checking a Notes view for client requests to appear. These documents were calls passed on from level one support. If a consultant thought they could fix a call they would “grab” the call from the queue and allocate it to themselves. Since level two did not deal with the clients themselves, the system was designed so that the consultants could rely on the description of the problem in the Notes document. They would then attempt to fix the problem, and pass the document back on to the level one support to be relayed back to the client.

An interesting aspect of the system was that it had been designed to allow communication going outside the system. At times level one would need to contact level two more directly, and the system allowed documents to be sent through electronic mail. Alternatively, level one could telephone level two directly:

"On the whole most people use the CR [call reporting] system. Sometimes because of the delay they’ll phone and say 'I've got an important CR' can you take a look. Sometimes they might not put some information on it and it needs to go back and if it becomes urgent they can actually tick a box and it gets mailed to us. [...] Certainly for Australian calls they tend to tick it."

(AS/ther1)

"If it’s an emergency and they’re at a client's site level one’ll call us - I mean they can’t Lotus Notes us from a site."

(AS/OM)

So while the system had been developed to track as many calls as possible, the staff were still able to “break out” of the system if they thought it necessary.
Although Notes was used heavily for this application, the IS department had not pushed the development of other applications in other parts of the company. Some staff had taken on themselves to develop applications to help their jobs, such as keeping track of faults on test systems, but no other database had achieved the widespread use of the call tracking system. Notes at Living Technologies remained synonymous with the call tracking system. Notes had not caught the imagination of the staff, and it remained useful yet undramatic.

3.3.3 Infrastructure or application?

This is in contrast with companies which had Notes installed on every machine. There, Notes was seen as more of a "universal tool", to be used for any sort of _ad hoc_ software development:

> Internally X use Notes a lot. They have a busy Notes team who just do Notes development internally. It looked like there was over 1000 odd different databases in the system. Uses included travel requests, CV for everyone in the system [...] Said that she was working on an Access database just now. Asked her why she wasn't using Notes. Apparently they are very strict that in-house they have to use Notes for everything, but this program was potentially going to be sold to other people. "Lots of other companies don't use Notes"

(_erh/HS_)

Using Notes nearly always involves some software development, but since Notes is a fairly 'low maintenance' development environment, in that databases can be quickly written and tested, it is possible for companies to develop their own small applications. Doing this, Notes seems to fit a niche as a system which can be used for low-cost local software development:

> There are five Notes developers, 1 contractor and 2 who are part time [...] the big application has been the menu database which everyone uses. "When we first rolled it out we didn't advertise it but everyone went to it at 11:55 and brought the whole server down!" [...] The databases they implement will often be just for a case and then thrown away six months later when the case is finished.

(_ery/SC_)

As a law firm, developing a custom application for the restaurant menus would not have been practical (in terms of cost) for this company if it was not a fairly simple job. Several other organisations had active development in Notes:

> They have about 400 applications which translates into 1200 databases [...] They have five full time Notes developers.

(_nwr/M_)
Said he couldn't imagine the company doing its job without email and that it's getting that way about Lotus Notes.

(gee/RM)

They do a lot of their core business things in Notes - staff booking, "SID", "SAM", information databases ... Growth of about 6-10 databases per month, 1200 users [...] Any database which is less than five days [to develop] will be developed on a favours basis. Over five days a business case must be made and every three months a group meets to discuss what development to do.

(erh/IC)

In these companies Notes took on the role of being the 'infrastructure' for custom application development. For small jobs such as "staff booking" or "restaurant menus", applications could not be easily bought off the shelf. With Notes, these applications could be easily written from scratch and since Notes was installed on everyone's computer, writing an application would only cost the time of the developer. While several organisations had experimented with charging individual business units for development, the most successful seem to be those who had just left what was to be developed to the discretion of users and developers ("a favours basis").

3.4 Notes at Narajo

In my first interview at Narajo, M (Narajo Oil's main Notes analyst) commented that Narajo "couldn't run without Lotus Notes" (col/MB) and when I toured the company, every machine appeared to have Notes running. When I started my field study a month later, I discovered this was only a slight exaggeration. Everyone used Notes, whatever their location or job20. Some company-wide activities, like booking holidays or rooms, had to be done through Notes, mandating a certain level of Notes usage, and sending and receiving Notes messages was certainly an essential part of all jobs.

Narajo Oil was part of a larger world-wide operation. Although fully owned by its American parent company, Narajo had considerable independence, with the running of the company being in the hands of its own managing director. One implication of this was that its information systems were separately run, to the extent that Narajo had adopted Lotus Notes around 1992, whereas the world-wide operation only decided to adopt Notes five years later. The IS department prided itself on its progressiveness, and discussed the Narajo American IS with some irony.

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20 This is not completely accurate, since some staff (those who worked for an outside contract company) such as the catering and cleaning staff, did not use Notes. As I finished my field study, however, there was discussion of installing a machine in the kitchen so Notes could be used to get sandwich orders to the kitchen staff.
3.4.1 Methodology

The study of Narajo used a data collection technique known as *participant observation*. Participant observation involves the in-depth study of social settings by taking part in the activity being studied. Participant observation is a popular method used as part of "ethnography", an attempt to take the view of those being studied (Cooper, Hine et al., 1993; Anderson, 1994). Ethnography involves:

>a particular method or set of methods ... involves the ethnographer participating, overtly or covertly in people's daily lives for an extended period of time, watching what happens, listening to what is said, asking questions (p1, Hammersley and Atkinson, 1995)

To study Narajo I spent three months observing and working in the Information systems department (IS). During the study I worked part-time as a programmer developing a new computer timesheet system. Timesheets were used by Narajo to keep track of time worked on various different oil fields and tasks. Although I was only working part time, I went to Narajo for a full working week and this gave me access to the different parts of Narajo and time to conduct interviews with staff. Since much of the Notes system used at Narajo was open access, I was also able to monitor electronically how different parts of the Notes system were used. In particular, Notes was used considerably within the IS (Information Systems) department in which I worked, providing an opportunity to study its use physically *in situ*.

While at Narajo I collected field notes observing what had gone on, along with tape recording interviews with staff. Since opportunities for extensive note taking were often lacking, when I quote my field notes they are often summaries of events, rather than quotes from staff (more common in reports of qualitative sociology). From these fieldnotes and interviews I prepared an index of analytic themes, which I used to develop the analysis presented here. Section 6.4 discusses the issue of analysis in more depth. The methods of participant observation (and ethnography) are now commonplace in sociology (Loftland, 1971; Morgan and Smircich, 1980; Burgess, 1984; Bryman, 1988; Goffman, 1989; Rosen, 1991; Fine, 1993).

A more innovative feature of this study is in its use of electronic observation techniques. Since I had a status at Narajo as a software developer, I had access to many of the databases used inside the company, providing the opportunity to monitor their use, view on-line discussions and print out suitable extracts. This proved to be a particularly useful device - data could be printed 'ready transcribed'. However, there are some dangers in that the data can be observed outside the context of its production and consumption. For that reason, I have limited my observations to databases in which I knew (or interviewed) those contributing, or which were of a Narajo-wide
public nature. This also side steps ethical questions regarding the analysis of private
data collected from those who may not even be aware of my existence. While
information posted to company wide public databases is “in the company domain”,
the precaution has been taken of anonymising all data, along with company names.

3.4.2 Notes at Narajo: Overview

To the staff at Narajo, the most important feature of Notes was its electronic mail
system. This was used throughout the company and the staff attached great
importance to this feature. Sending and receiving "Notes" (as mail messages were
called) was a normal part of the job. Of the twenty two staff members interviewed
during my study, a rough average was to receive ten notes per day. Other Notes
databases were also commonly used. Some examples of these are given in figure 3.6
(page 81). As might be expected, usage was particularly high in the IS department (the
centre of where the study was conducted). IS staff were the most technologically
literate, the IS manager had been a keen Notes advocate, to the point of developing
some of the databases used within IS himself:

John starts to discuss the history of the IS purchasing database.
"Originally it was done on paper pads, where you just wrote your order on
it and passed it to P (the old secretary). Then S (the IS manager) wrote a
simple Notes database to do it, and everyone said to S that it was great, but
what if it could do this... and what if it could do that. People just kept
going to S.... Eventually it got more and more complex. When he
introduced the financial views to it, I thought 'he’s rewritten oracle
financials'"
(11/10.1)

As a "groupware" application Notes is often described as an application for the
sharing of information. This was done at Narajo with some success. Its computerised
nature meant that the databases it held were available regardless of office location or
time. Information stored in Notes was always available. The geographic
independence was also important for the ease of use. One example of this is the
library's listing of its holding of maps and charts. By placing this in Notes, anyone in
either of the two Narajo sites could browse the catalogue without being in the library.
Access could also be given to those in dispersed sites. Narajo even had links out to its
oil platforms so that Notes could be accessed from the middle of the North Sea.

Notes is asynchronous. This means that messages, changes to databases, etc., remain
on the server to be accessed by readers at their leisure. That the time something is read
can be distinct from when it is sent is at the heart of the utility of Notes. Any
communication with Notes can be protracted through time. At Narajo, this allowed
communication to be done when suitable, the choice of when to reply or read is that of
the individual, allowing communication to be flexibly integrated into the working day. Electronic mail particularly benefited from this, since it could be used to avoid "telephone tag" - the exchange of answering machine messages without actually getting to talk to someone. Of course, a down side of this was that the choice to read a message rested with the receiver. There was not the compulsion of a spoken message.

3.4.3 Four types of Notes database

As can be seen from figure 3.6 (page 81), Notes is used for a range of different applications. These can be divided into four different types depending on what the database is designed to do: Mail, Public forums, Workflow and Tracking. Similar distinctions are made in practitioner discussions of Notes, such as the Notes manuals from Lotus (Lotus Development Corporation, 1996).

Electronic Mail

Electronic Mail is perhaps the most familiar of Notes applications and was heavily used at Narajo. I found that if the receiver of a message was in the office, a message sent would normally receive a reply that day. Indeed, one interviewee expressed frustration with the few employees who did not read their mail during the day, but read it each morning or evening.

The use of electronic mail in organisations has been the topic of some research, particularly within the field of Computer Mediated Communication (CMC) e.g. (Culnan and Markus, 1987; Bannon, 1992; Steinfield, 1992). Unfortunately for our purposes, CMC has been strongly influenced by psychological concerns, and social psychology in particular. This has led to an dominance of formal models, and very little in-depth analysis of email use. A complete consideration of how mail at Narajo was used is outside the scope of this thesis; it would make up a book in itself. But mail is important in understanding how Notes was used, however, so a few points can be made.

Staff at Narajo used Mail in a creative way, intelligently using the facilities that mail offered so as to best help them get their job done. One of the most useful features of mail was that it could be addressed to multiple people. Without the potentially difficult job of getting people together at the same time, a message could be sent to all the interested parties. Often everyone in the IS department would receive "For your information" messages:

From: XXX
To: IS
cc:
Subject: S&F mins

FYI:

The next S&F meeting will be on 4/12/96 at 10:00am in B127. P. will be in the Chair.
Please meet in the helpdesk at 09:50am to do the tidying up of HD, A. & student's area, Computer and Plot Rooms.

(Email 27/11)

These messages informed the whole IS group of something of importance to everyone in the department. However, there were also communication situations which would have been difficult to achieve using mail messages. Face to face meetings were often held to come to some sort of agreement over important issues. These meetings involved a gradual “working up” of consensus between the participants, involving considerable discussion of different points (section 4.4.4 discusses this 'coming to agreement' with regard to software development). This would have been difficult to achieve over mail.

Communication could often take the form of email combined with other communication media. Take, for example, the common “short request” mail message. This is a short message, sent to ask for a unproblematic task to be done by someone else in the organisation. An example is shown below:

From: J.
Date: 30/08/96 10:05:46
Subject: Barry Brown

P,
We have a temporary (4 months) Notes Analyst working here called Barry Brown. Could you add him to SSW for Internet mail, but not bother with ARCS?
Thanks,
J.

(mail 30/08)

These short messages were useful, for the requester at least, since they lowered the amount of effort needed to get something done. With this, however, a problem arose. A mail message is not very intrusive and is easy to ignore. A mail message does not emphasise its importance as much as, say, staying in the recipients office until they do what you want. The message, therefore, could be supplemented with actually going to see the person and disturbing them to emphasise the importance. These short meetings would invariably start with the question “Did you get my note?”. This was
not questioning the reliability of the mail system, but asking why have you not done it?

Mail was also used extensively for its *representational* features:

"We’ve always used it for proof... having chased it or having said something to the person, because obviously it can’t be proved on the telephone - this is like hard evidence, if you like." (139)

Thus mail could be used as an ‘audit trail’. A mail message stored in your mailbox is a record that you have received some information and this could be used to show that you had been informed about something you might later deny. An example is the use of mail to arrange staff meetings at Narajo - an activity which was often chaotic, with times and venues being frequently changed by the group manager. Since meetings could take as much as a quarter of a day, staff would claim they did not know about a time change to get out of going to the meeting. A group message sent from the manager could be used to contradict this excuse - to the point where the staff member would have to admit to having ‘forgot’ or ‘missed’ the message.

Meeting starts with K asking “has anyone seen M this morning.” M is given a phone call to remind him about the meeting. [...] M arrives claiming that he didn’t know the meeting had been moved. K emphasises that he’d sent out a message, asking everyone else round the table if they had received the message. Everyone says yes. M admits that he must have missed it. (16/11)

Messages could also be used as a form of commitment through the public re-reading of messages at a later date. A message committing to something then became a way of establishing ‘who’s fault it is’. Although pointing the finger was frowned upon by management, it was still used as a very effective way of getting something done. By fingering the guilty party, this placed the onus on them to put it right. During the writing of the timewriting system, for example, a feature that had been promised by myself via a mail message had not been put into the working system. ‘Pointing the finger’ allowed other staff to pressure me to fix it. As can be seen in the following extract from a mail message there is a reference to a feature not yet implemented. There is an implicit reference to an earlier mail message where I agreed to implement this feature:

From: J.
To: Barry Brown
Barry,

The points I have so far are as follows:

- The system currently allows more than 24 hrs per day to be input.

(mail 10/11)

Compared to recollections of spoken conversations, the production of a printed mail document could be particularly effective. So long as messages or document could be found, they were ideal devices for establishing an account of previous events21.

This depended on finding the original message, however, not something which was always easy:

Discussed some work M thought I could do. M couldn't remember the details of this so the email became a source for searching for this. Tried to do a search on a half remembered name in the name and address book. Then on that person in M's mailbox. Then on messages from K because K had been involved in it. M said that he thought he had "lost some email". In the end we went out looking for K and couldn’t find him. When we finally found K he had a different recollection from M - he thought they already had a system which could be improved.

(28/8)

Public forums

While mail use at Narajo was important, it was a fairly conventional use of Notes. More interesting were the databases designed to be “public forums”. These were places where everyone in the company had the ability to read or post messages. Three forums were heavily used, an employee notice board, a company bulletin board and the challenge database (a good ideas database):

"Email, bulletin board, and the employee notice board. They're the three basic ways of communicating"

(I30)

21 (Yates, 1989) argues that similar reasons were behind the increase in the use of written organisational communication at the turn of the century.
"The noticeboards... I check them regularly, I was away last week and I had a lot of catching up to do. I primarily check out the employee and company. I browse them daily."

"Oh yeah, I do, I look at that every day. It's quite useful. I think that's nice - it's employees communicating on a personal basis. I think it's really handy, I've put stuff on it many a time."

"I go to the notice boards occasionally... once a fortnight."

While the description "forum" might evoke notions of a situation where a free exchange of ideas can take place, this would be to ignore the limitations of the databases and their embeddedness in organisational life. Communication usually took place outside Notes, and made the databases less forums and more ways of publicly demonstrating what had been discussed in private. An example of this is with the "challenge database", used for the company wide good ideas scheme. Before a suggestion was posted onto the challenge, it would be normal to consult those whom it might affect. Ideas would often only be implemented if they could convince the relevant staff of their viability, and surprising them with a public message might not be the best way to do this. In one incident a message was posted suggesting the setting up of an "Oracle User Group" committee to improve the support for the users of the Oracle system. Unfortunately, there was a staff member who already had this as their responsibility and this led to an angry exchange of phonecalls. Eventually it was resolved by the original author deleting his suggestion, something which involved getting the Notes administrator involved, since it could not be done by a normal user.

As a public forum, the challenge database had a more sophisticated life than a simple "ideas box". With ideas posted to the database being public, it was as much a forum for public congratulation as for "suggestions". Some of the ideas posted onto the database had already been implemented by the time they were suggested. This made the purpose of the posting more one of rewarding the initiator than "suggesting" the idea. Moreover, to get the database used an unusual range of techniques were employed. A football metaphor was applied throughout the database. Suggestions were either “hitting the post” or being a “goal”. This playful metaphor was carried on throughout, with a teddy bear being awarded for each suggestion made. Cash prizes were offered for the best suggestion each month, and by posting an entry onto the

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22This misguided conception of forums is common in CMC. (Hiltz and Turoff, 1978) discuss the use of conferencing in organisations, and Sproull and Kisler talk about the use of electronic noticeboards at some length (Sproull and Kiesler, 1991). See also (Zuboff, 1988).
challenge database the proposer became a member of the company's share scheme (basically a substantial Christmas bonus).

The reason these incentives were needed was the "passive" nature of communication databases. Unlike a telephone call, or a knock at the door, a message on the notice board would only be read by someone actively using Notes. It did not disturb or directly invite readers. In previous years the ideas database had failed - with only a few suggestions being contributed. This year, IS staff felt that without some sort of incentive or encouragement, messages would not be read, and very soon not be posted. Accordingly, incentives ranged from teddy bears to money prizes. Peer pressure also played a part - reading the forums was seen as part of being a 'good corporate citizen'. Throughout my interviews, staff mentioned that they felt they did not read the forums "as much as they should" and even the managing director mentioned them at his monthly 'pep talks':

S (the MD) talks about using the challenge database. "12 people haven't participated ... You've got 16 days to get part of the team"

Workflow

Along with electronic mail and the public forums, Notes was important as a platform for running what are known as "workflow" applications. These applications are so called because they involve the movement of some "work", usually a computerised document, from person to person. This is an attempt to computerise conventional "organisational processes" where a paper document is moved around the company. Being computerised this "flow" is standardised, with the document being passed electronically from worker to worker. Workflow is an attempt to structure the actions of staff by automating the flow of the work between individuals. This 'structure' can be applied with different degrees of flexibility (Dourish, Holmes et al., 1996). Workflow has been the subject of considerable research, e.g. (Aussems, 1994; Boersma, 1994; Ramage, 1994; Carlsen, 1995; Joosten and Brinkkemper, 1995), but mainly from a technical perspective.

Lotus Notes is not strictly a workflow system, since it does not have the features normally associated with such systems (May, 1994); workflow systems usually include explicit features for modelling the flow of information in an organisation, and automating that flow using computer communication. Its functionality is such, however, that building a workflow system with Notes is relatively easy. Its close connection with electronic mail means that mail messages can be used to prompt staff
at each stage of the work, and a document can be designed to work in different ways as it moves through each stage.

An example of a simple workflow system at Narajo was the "Oracle Code Change database". To change the finance codes used on the central Oracle financial computer system, it was necessary for a request to be submitted to this database, be approved in this database, and then finally delivered to the financial computer's administrator. The database structured action in two ways. First, the particular information put into the request was restricted to fields on the form: code, type of change, reason and so on. Second, the flow of the form was structured so that each request was sent to a suitable approver, and if the code change was approved, in turn sent on to the Oracle system administrator. This workflow is a very simple submit-approve-action workflow. We return to discussing this database is section 3.4.4, when we look at how it was actually used.

Tracking

If workflow is an attempt to add structure to action, tracking is an attempt to structure things. That is, Notes can be used like a standard database application, holding a record of some other phenomenon to be referred to when necessary. Being held in a computer, that record is structured, and Notes was particularly flexible in how it allowed one to do this.

When the IS staff upgraded the Oracle computer system to a new version, it was necessary to go through all the existing financial reports on the system and check that they worked with the new version, completing any necessary repairs. This was a cumbersome task — there were thousand of financial reports on the system and often each report would take a considerable time to test and repair. Three IS staff members worked on the upgrade and a number of finance staff helped out with running the different reports. To keep track of all this activity, a Notes database was written which listed which reports had been tested, details of the report, the status, the changes etc., and so on. Although this was a fairly simple database as a shared resource it was useful for the developers in keeping track of their actions.

The database thus offered a structured account of action, ordering it all in terms of application, report, repairs needed and so on. Various views meant that not only could the information be analysed in terms of what was still needed to be tested, but also who had done what, and what repairs were most commonly needed. The database structured all the different activities taking place simultaneously on the Oracle system and presented it in a meaningful format. In this way, it was a 'representation' of activity.


The Failed Databases

A discussion of Notes at Narajo would not be complete without considering the databases which *did not* get used. About 600 databases were on the system, while about 100 were regularly used. A large number of databases had been created but were no longer in use. The system administrator claimed that this was the nature of Notes databases - they fulfilled a purpose for a short time, but the need changed and the database wasn't needed any more. This hides a more complex story - some databases were never used, while others seemed to fall out of use gradually. An example of databases which fell out of use are the diary databases, used by some departments to keep track of who was in and out of the office:

X: Exploration diary - the rest of exploration fill that in. We don’t. I tried to get our group to. It just says who’s where, who’s in, out. But they won’t do it so I’ve given up on that. But it’s good seeing who else is in or out.
Me: Why’d they not do it?
X: They just hate doing it.
(129)

“This one (the diary database) I’m really angry about. Everyone is meant to put where they are and when they’re out of the office, but nobody does. I guess they use their own diaries and I keep a group diary. But I’m going to try and resurrect it for 97.”

(123)

Staff spoke about how they started to use the Notes diary but that it eventually fell out of use. Some groups did successfully use diary databases, with a key factor appearing to be a administrator who periodically “reminded” staff to use the database. Grudin’s study (Grudin, 1989) on why electronic diaries were not used illuminates some of these problems. To Grudin, it was a lack of balance between those who did the work, and those who got the benefit. While this might have been the case at Narajo, other, more prosaic, reasons were also given by staff. Some of the excuses were that:

1. The database did not work
2. Was auxiliary to the job, so when staff were busy they would stop using them
3. Did not seem useful enough for the effort needed to use them
4. Did not get updated, so they got out of date and so did not get used
5. As staff changed, they did not know the database existed and stopped using it

During my time at Narajo, I noticed databases fail, or failing, for these reasons. A particular problem seemed that databases were often secondary to the work task - they tracked, or followed activity (like diaries) rather than being a central element to that activity. Databases which were key to doing something - such as purchasing using the
low value orders database - were successful, whereas databases secondary to the work (such as discussion databases) had less success (see also section 6.3.2).

3.4.4 Technology as a means to an end

While the above description gives a picture of the sorts of applications which are built using Notes, it only briefly considers how these different applications are actually used. As was mentioned in the last chapter, consideration of this topic is still very much in its infancy. The details of use are distinct from the technical details of technology, but often are collapsed into them. For example, the technical design of computer database systems is a topic which has attracted a large amount of interest within computer science, with a number of different journals, conferences and courses dedicated to it. This is in contrast with studies of the actual use of databases, of which there are few examples.

One example that demonstrates how the use of technology can be studied is Nardi and Miller's investigation of the use of spreadsheets (Nardi and Miller, 1990a; Nardi and Miller, 1990b; Nardi and Miller, 1991). Using data from in-depth interviews, Nardi and Miller showed how spreadsheets, which were previously considered as a single user financial application, were in fact used for complex collaborative problem solving. Paper copies of spreadsheets could be distributed among staff, and returned with annotated corrections and suggested improvements. Moreover, a spreadsheet could be "walked through", staff could physically sit around a printed spreadsheet and ask questions about the assumptions in the financial model. This was a form of collaborative troubleshooting, where erroneous assumptions or calculation errors could be found by staff interacting around the sheet. Spreadsheets are described by Nardi and Miller as 'sites' for collaboration, rather than just single-user financial models. Research of this kind reveals how when technology is put to use it becomes incorporated into the job. This is not something which is determined by the technology, but rather is a complex "appropriation" by the users of technology to fit the specific details of a given job. This "appropriation" is the use of a technology in a creative and original way that appropriates the technology to the needs of a particular job.

Orlikowski's study of a Notes technical support application, described earlier, demonstrated similar appropriation (she calls this "opportunistic modifications to both

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23Studies of the end use of databases which do exist are usually in the form of business case studies where a database is used to achieve competitive advantage, or alternatively a discussion of an innovative technical feature (Strassman, 1985; Ciborra, 1994; Tarumi, 1994; Lai and Turban, 1997). Neither of these types of study investigate 'use' in any sort of depth.
technology and the organization”). There staff learnt how to best use the system so they could speedily find answers to customer’s problems. Who had contributed a potential solution to the database, for example, became a quick way of evaluating a solution. Some staff members gained reputations as good problem solvers, so solutions authored by them would be more likely to fix a given problem. The use of the call system was therefore not just determined by the form of the technology but was creative in that it involved the intelligent appropriation of technology to the job in hand.

To expand the consideration of Notes in this direction, the notion of ‘device’ will be used. As a technology is incorporated into the work, it comes to serve a certain purpose, and to be used in a certain way. How it is used is what sort of device it is. A book, for example, holding a door open is a "door holding" device. Or if it is used to knock a picture hook into the wall it is a "hammering" device. The notion of device underlines that how something is used is distinct from both its design, and its intended use. From observations at Narajo four 'devices' were identified at Narajo: interactional, symbolic, political and ordering. These cover the different ways in which Notes was utilised by staff in doing their job

*Interactional device*

Notes as a "interactional device" is a good first example to demonstrate the concept of a device. One way in which Notes was used at Narajo was as a device for helping steer a conversation in a certain direction. The Narajo IS purchasing administrator used the "Vendor Information database" in this way. This Notes database had various details about different vendors, their contact addresses, and the products or services they sold. In the hands of the purchasing administrator, however, it also became a device to avoid becoming entangled in sales calls. Telephone conversations would go like this:

(Phone rings)

A: Hello, Jane Stuart, Narajo Oil
B: … (unheard reply from telephone)
A: Can I just stop you there... is this a sales or marketing call?
B: …
A: It’s just that if this is a sales or marketing call, then before Narajo will do business with anyone you will need to complete a vendor information form - it goes into our database which tracks all the vendors we can do business with.
B: …
A: I can fax you a copy. What was your fax number?
A sales telephone call (I11.1)

This allowed the administrator to manage sales calls by making them complete a vendor information form, which would then (eventually) be typed into the database. Since the completion of the form was a prerequisite of doing business with Narajo, this effectively redirected the salesperson’s spiel onto the completion of a standard form, something which could be managed more easily than a live salesperson on the other end of the phone. So while the database was designed as a way of finding sellers when Narajo was looking to purchase something, it was used as a device for dealing with nuisance sales calls. This database was therefore a "interactional device", a way of controlling interactions with salespeople.

Symbolic device

A second way in which Notes came to be used was as a 'symbolic device', a way of indicating the status of some issue, of awarding it a particular meaning. The clearest example of this is the “challenge database”. As discussed earlier, the challenge database came to be used less as a means of suggesting good ideas, and more as a way of publicly presenting ideas that had already been successful. Posting an idea to the database which had already been implemented was obviously not a way of suggesting an idea, but rather a way of accrediting an achievement. The database was a ‘device’ for recognising good suggestions rather than facilitating their discussion.

Another example of the use of Notes as a 'symbolic device' was the holiday request database. This database listed the holidays requested by staff in the company. However, this database was the end product of the holiday request process, rather than a medium through which requests would be presented. Discussions took place on the telephone, or face to face, over the allocation of holidays and once a decision had been made, then an entry would be put into the “holiday request database”. To protect privacy, staff could only see details of their own holidays, so it was not used as a means of communication. Instead, it was a record of an arrangement made outside the system, not a means of communicating that arrangement. The database symbolised the agreed holidays in an official form. Once the details of holidays had been put into the database, staff and management were committed to those holidays, the database acting as a symbolic marker.

Political device

All databases have a political life to some extent, in that they become involved in the distribution of work and resources around the organisation. Databases, by their very
nature, are used by groups of people. These individuals might have very different desires and requirements from each other, which might be different from those of a database developer. For these reasons, the design of a Notes database, might not offer suitable or desirable features to help a particular individual to get their job done. Yet, compliance and use of this database might not be optional, but organisationally mandated. So although a database might not be particularly helpful, its use could be enforced by management.

In this way databases can be used as political devices - as ways of influencing the balance of resources, power, or the division of labour in an organisation. An example of this was the Narajo timesheet database, used to track the hours staff worked (discussed later in chapter 6). The design of the database forced those who filled in their timesheet to look up their own finance codes, rather than leave this to the finance administrators. Originally, with the paper version, some staff members had only written descriptions their timesheets and left the codes to finance staff to look up. The Notes database forced staff to look up their own finance codes therefore enforcing a division of labour. This was at the heart of many Notes databases: they gave management the ability to control the actions of staff. As was said in the presentation of the database to management:

"this system has enhanced controls because the controls are computerised. Just now an approver can scribble anything on the timesheet" (24/10)

Markus discusses a similar example of databases being used to control the division of labour in organisations (Markus, 1983). In this way, a database may be a political device to force other people to work in a certain way. A database may benefit one person, but handicap another. It should be noted, however, that even if one is forced to use a database, its use is an ongoing contingent development and may be resisted. Where the use of a database is mandated, and the system does not fit, or is not useful for the work, then staff will 'hack' the database to their own purposes. Disputes over how certain databases were to be used occurred in Narajo on a number of occasions, with staff often having to be cajoled into using databases (see section 6.3). Databases can thus be used as devices to force staff to work in certain ways, although staff can resist or subvert these restrictions (for other examples, see (Button and Harper, 1993; Bowers, Button et al., 1995)).

Ordering device

Of all the ways in which Notes was used, the most pervasive was the way that Notes was used to present an ordered or structured account of the world. Staff used Notes
as a device to structure their own and their colleagues' actions, along with the
accounts of those actions. To structure something is to place it into some
predetermined form. That 'placing' puts constraints on what is valid and invalid.
This ability to provide structure works in two ways. First, there are constraints on
action — these are limits on what can be done with the computer, which can be used
by the staff to shape and influence their own actions. Second, computers can be used
to provide a structured account. That is, a description held in a database which is
neatly ordered in such a way as to make what is being represented appear neatly
ordered. The use of Notes in this way can be compared with Bittner's discussion of
how the notion of "organisation" is be used to structure accounts of organisational
action (Bittner, 1965), Zimmerman's discussions of rule use (Zimmerman, 1971) or
Bittner and Garfinkel's discussions of medical record keeping (Bittner, 1967).

Two examples from Narajo can be used as illustration. The “Action Request Log”
database was used at Narajo for making maintenance requests such as changing a light
bulb or oiling a door. Once a request was made (and anyone who had access to Notes
could make a request), it would be allocated to a technician who would fix the
problem and then “close off” the request in the database. The form on which all this
was done included a description of the fault, its urgency and so on (figure 3.7, page
82).

What happened in practice was that once a request had been made (“could you change
my lightbulb”), the requester did not receive any response until the repair man came
round. In most cases, the repair would be at the office of the requester, so the
appearance of the repair man would count as a reply to the request. If there was a
delay in the repairman appearing, or if the requester was impatient, they would phone
the repairman directly to “make sure you got the request”. This was not a sign that the
system was unreliable, nor that requests got lost, but was more a gentle prompting for
the status of the request. In one situation I observed, a colleague made a request about
a flickering light, later following it with a phone call since she had not received a
reply, with the repair man appearing just as she made the call. If the repair was in the
office of the requester, the particular details of the problem could be discovered at the
site of the repair. Since problem requests were often ambiguous, a telephone call
could be made to supplement the written details of the fault.

The database offered a way of structuring action. A workflow had been designed,
with information passing from staff member to repairman through a formalised
communication channel. This channel is useful since it gave a quick way of
requesting a repair without having to get through to someone on the telephone - just
go to the database and fill in the form. The workflow, however, did not determine
what happens. The workflow is integrated into the job of "getting something fixed", something which can involve discussions at the site of the repair. Moreover, if the workflow does not satisfy the urgency of the repair, staff will ignore it all together and call up a repair man directly. Staff members were happy to use the structure provided by the database when it helps them and they were also happy to subvert it if necessary.

The use of the database in this way is similar to Bittner’s discussion of the “gambit of compliance” (Bittner, 1965). An organisational rule (in this case in the form of the structure of the Notes database) is used “to inform a competent individual about the proper occasional and form for doing things”. The rule is a resource for deciding what is organisationally proper to do next.

In Bittner’s discussion, the rules have a second function. Rules allow us to make sense of other individuals actions, they help us understand the meaning in an activity. A car indicating and turning in the middle of a road makes sense because we are aware of the highway code rule for making a right turn. The rule helps us to see the order in the activity. It is similar with a database, where the structured account it produces of the repairs at Narajo helps to display the activity as sensible.

One use of the database could be to present an ordered and neat list of all the repairs and when they had been completed. Whatever the messy contingencies of individual jobs, this were lost in the account given by Notes. This account could be used to justify the orderliness of the process – just look at the record in the database.

A second example of how a database could be used as an ordering device can be found in relation to the “Oracle code” database. This system was used to track requested change to the financial codes in the central Oracle financial computer system. Users submitted requests to a particular approver, asking for changes to the centralised financial codes which the Oracle system used to control costs. A message was then sent to the approver asking them to approve the change, and once they approved the code change it would be sent to the Oracle system administrator to actually change the code on the system.

Although the code change request form was designed to capture as much of the information about the code change as possible, in many cases the approver would need to talk to the person submitting the change, so he or she could discuss the details. In other situations, the change could be particularly urgent, so the submitter would talk to the approver and ORACLE system administrator to ‘nurse’ the change along. While the system had a set workflow, this did not determine the lines of communication which took place even in a typical code change. Each code change had to go through at least three steps - inception (filling out a code change form),
approval, and then closure (with the code changed on the central computer). However, around this structure what staff did was flexible. Rather then the structure being imposed upon work practice and determined how the work is done, the process was used by the staff as a resource for managing the process of getting a code change done.

The database also served a second purpose, as a record of the changes done to the Oracle database. This was important in maintaining a view of the code change process as an orderly, sensible process. The financial systems in the company would be periodically audited by managers from outside the local company, and the record in the database was important in showing and demonstrating that the process was well managed. While the account in the database is only a idealised account, one which ignores the individual details of what went on in the case of each code change, for this purpose it is satisfactory. It extracts the order from the activity and presents it as a view on the work. Work, politics and communication would take place around the entry in a database, with the database being changed as the symbolic marking of that decision. Work did not “go virtual” or take place within Notes, instead Notes was a structured indicator of the ongoing work taking place in the “real” world. The work in question is complex and diverse, yet through the design of the database its orderly features come through. That is to say the matters of relevance are displayed by the database. That is to say, the world is shown to be orderly and structured through the design of the database. Thereby matters of relevance to the task at hand are made available (chapter five discusses this issue in more detail).

3.4.5 Creative use of telephones and spreadsheets

As these examples show, the use of Notes was varied and creative in that it was not determined by the design of particular databases. Notes would be used as a different 'device' in different situations, woven into the fabric of the work. The descriptions above give us a view of Notes, not from the point of technical design, but rather as 'creative use', as something which is actively and creatively incorporated into work in different ways. Each of the different 'devices' helped staff to get their jobs done, be it by getting sales people off the phone, or convincing financial auditors of the orderliness of a process.

This notion of 'device' can also be useful in seeing how other types of technology were used. These technologies were creatively incorporated into the working day, and used as 'devices' to different ends. Here two examples are presented, the internal telephone system and spreadsheets. Since the topic here is Notes, the discussion will be brief, but looking at these other technologies shows how the notion of a 'device' can help in understanding use.
Narajo had recently installed a modern telephone system with both Caller ID (showing the telephone number of whoever is calling as the phone rings) and Voice Mail (a form of personal, electronic answering machine). It was observed that in interviews, meetings, or even just incidental chats, the ringing telephone would spark some unexpected behaviour. Rather than the usual procedure of answering the phone, the receiver of the call would turn, glance at his or her phone, and then either answer or ignore the phone. In most cases the phone would be ignored rather than answered, with the phone being redirected onto voice mail after several unanswered rings. When conducting interviewing in other companies (without the more advanced phones) the phone would usually be answered and an arrangement to speak later made.

A clue to what was happening here is given by one incident in an interview at Narajo. An accounts clerk was being interviewed, and the phone rings resulting in the by now usual glance and then ignore. When the phone rang for a second time during the interview she answered it:

"hi... yeah,... I saw that you'd called twice, so I thought I better answer it"

(114)

In ignoring the call she had checked to see the number of the caller. The second time, she recognised the number, assumed that the call must be an important matter (since the person had called twice) and answered the phone, rather than letting it go on to her voice mail. The "glance then ignore" procedure involves viewing the number of the caller as a clue to the importance of the call, and then making a decision about whether the call is important enough to answer or leave to the voice mail. The person calling in this example is also aware of this behaviour - he or she calls twice knowing that they had been ignored first time.

Although this effect of Caller ID and voice mail in combination is presumably accidental (both technologies having been developed separately) it provides excellent support for not answering the telephone. Voice mail abates the rudeness of not answering a call, by offering a facility to continue the communication without a direct connection. Since nearly everyone at Narajo continually checked their voice mail one could be sure the message would get through fairly soon. This makes not answering the call less of a reprehensible action. Caller ID, on the other hand, provides us with information to support the option to answer the phone, rather than a compulsion. With Caller ID we can catch urgent calls (or those that can't be dealt with through voice mail) while passing calls off which we can deal with later.
Use of technology this way - as a device to manage not answering the phone - has developed independently of both the design of Caller ID and Voice Mail. Being able to “glance then ignore” is so useful that this behaviour had been adopted by most of the staff at Narajo, to the extent that someone making a call is aware that this was what was likely to be going on at the other end. These technical features, in use, become a interactional device for managing when to answer - or not answer - the phone. As with the vendor database, the technology is used to manage interaction so as to make the job easier for the person concerned.

**Spreadsheets**

A different example of technology being appropriated in an original way is in the use of spreadsheets. Although normally considered to be a numerical/financial application, at Narajo they were often used to keep track of non-financial information. Their flexibility led them to be used as a simple form of database. Nearly every member of staff I spoke to at Narajo used spreadsheets to keep some sort of list. Some examples are given in figure 3.8 (page 83-86). It was easy to obtain samples of these tables - they were so frequently used they could be found lying next to almost any Narajo printer.

In a trivial sense, these spreadsheets were simply tables, used ubiquitously to present information. Spreadsheets had been appropriated as a simple way of arranging and adding order to ad hoc information. Horizontally, each row in the spreadsheet would represent one entity of a given type, say staff members. Vertically, the spreadsheet would be divided into columns with each column giving details of some attribute of that entity - such as name and phone number. This allowed relevant information to be kept in one place and to be printed in a compact form. At the simplest, these documents are merely lists, but more complex spreadsheets were also prepared. One of the secretaries designed a spreadsheet to track requests for research funding received by Narajo. This listed who had made the request, various details about the request, and its current status. These requests were split into individual sections, one for each year. If a new request for research funding came in, it could be added to the spreadsheet under the relevant year. Adding the proposal in this way would extract key details - such as the cost, start date or benefits to the company - from what might be a long proposal.

Since developing these documents could take some time, what advantage did the users gain by using spreadsheets as devices for organising information in this way? As computer files the spreadsheets were sharable and portable. Information which might previously have been distributed across a number of different sources, or held by different people, could be fashioned into a document which could be printed and

Page 73
shared on a notice board, or shared on a file server. These details could be distributed among groups of people rather than merely existing in one place. Since these documents were created in familiar computer applications they were *constructable*. The knowledge and expertise to create these orderings already existed throughout the organisation and was available with no extra training. The spreadsheet program itself were also freely available with no need to obtain permission from a department (such as IS) to use it. These documents were also *understandable*. They could be understood at a glance by nearly anyone. Any misunderstandings could be solved by asking the author to clarify particular details of the document. Lastly, these documents were *malleable*. Although the structure was an important part of their usefulness, this structure could be broken in a particular case, by simply typing a comment around a particular item or placing a footnote at the bottom of the spreadsheet.

Ordering information in this format meant that any number of entities could be listed down the table, with the same information extracted from that entity and listed in each column. Different geological surveys might not have much in common, but when viewed in a table their similarities are extracted into each column. The table provides the ideal method to find the similar in the different. In some structuring a particular ordering was important. Often this was in the form of dates, or financial amounts. Each line in the spreadsheet would be in order depending on its date, or cost, or some other variable. Ordering is a simple device which allows for comparing different items. By placing an entity in an ordering it can be compared with similar items. In other cases, a categorisation was more important, such as the year a survey was carried out, or the status of a particular issue. Like sorting, categorisations allow the comparison of similar entities, and often there will be an ordering on the categories which are used. Both ordering and categorisation allow for quickly finding entities. A list can be scanned to find a particular entity if the detail being sorted on is known. The position in the list can be used to quickly compare that entity to all the others in the list (this is discussed in more detail in chapter five).

The spreadsheet was an unglamorous device for extracting and displaying an *ad hoc* ordering. Its strength came from the fact that, unlike the Notes databases, the order came from how they were used, rather than from the design of the database. The order, while it takes its form on the page of the spreadsheet, comes out of regularities of use - using certain columns in certain ways - rather than the imposed order of a computer database. Spreadsheets are another example of an *ordering device*, a device used to present wayward phenomena in an ordered form. What is particularly interesting about the use of spreadsheets is that their development is indigenous, rather than being part of a system development project. Although it is a clumsy
phrase, spreadsheets can be seen as *natural ad hoc ordering devices*. Devices used to
display the flexible order of the small day-to-day details of work.

### 3.5 Conclusion

This discussion has covered considerable ground. It started by considering the
technical design of Notes and how Notes was used in different organisations. A
divide appears between those who saw Notes as 'just another database system', and
those who saw it as an 'infrastructure' for developing in-house applications. Two
organisations which had used Notes in a limited way demonstrated some of the
problems which need to be overcome to get Notes into an organisation.

This led onto the main topic of this chapter, the results from the study of Notes at
Narajo. This was divided into two parts: a discussion of the different types of Notes
database, and of the different ways these databases were used. Four types of Notes
databases were discussed: electronic mail, public forums, workflow and tracking.
These databases were designed to support different activities, and from the examples
discussed, it can be seen that they had very different designs. While this description is
helpful for understanding what sort of applications Notes is used to design, it neglects
the actual *use* of databases. To describe this, the concept of Notes as a 'device' being
used for some purpose was discussed. Four examples were given: Notes as a
interational device, a symbolic device, a political device and an ordering device.

Throughout this discussion, a number of different databases have been described to
illuminate different points. Looking at how they are designed and used shows that
there is more to Notes than just a simple form of communication. Instead, Notes is
incorporated into the work in interesting and original ways. This use is *creative use*,
an adjustment of technology to fit the needs of particular situations. Chapter five
continues this discussion, considering how Notes can be thought of as a
*representation*, rather than just as a form of communication. This change in view was
demonstrated above in the discussion of electronic mail, where it was shown that mail
was as important as a record, as it was as a way of communicating. Before this,
however, the next chapter discusses how Notes databases were developed and some of
the software development issues regarding the use of Notes. This reveals more of the
skill and management involved in designing and implementing Notes databases.
Figure 3.1
Notes Desktop
t/w pictures 1
<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADMIN</td>
<td>• UPDATE - RESTAURANT REFURBishment new dates for Xmas lunches.</td>
</tr>
<tr>
<td></td>
<td>• CHILDREN'S CHRISTMAS PARTY NOW SUNDAY: 8 December 1996</td>
</tr>
<tr>
<td></td>
<td>• HIRE CARS REFUILLING</td>
</tr>
<tr>
<td></td>
<td>• Last Postal Dates A Card makes everyone's Christmas...</td>
</tr>
<tr>
<td></td>
<td>• Daily Menu</td>
</tr>
<tr>
<td></td>
<td>• Richfield's 03/12/96 until 13/12/96</td>
</tr>
<tr>
<td>COMMERCIAL</td>
<td>British Gas Demerger</td>
</tr>
<tr>
<td></td>
<td>British Gas Network Code</td>
</tr>
<tr>
<td>FINANCIAL</td>
<td>• COST CENTRE CODES ORGANISATION CODES</td>
</tr>
<tr>
<td></td>
<td>• REQUISITION FORM Internal Requisition Form in Excel format</td>
</tr>
<tr>
<td></td>
<td>• EMP EXPENSE POLICY EMP EXP POLICY AND GUIDELINES</td>
</tr>
<tr>
<td></td>
<td>• EMPLOYEE EXPENSES Outstanding Advances</td>
</tr>
<tr>
<td></td>
<td>• TIMEWRITING CODES UPDATED 21/11/96</td>
</tr>
<tr>
<td></td>
<td>• EMPLOYEE EXPENSE REPORTS Expense Account Procedures</td>
</tr>
<tr>
<td></td>
<td>Financial Results Year to date Net Income is $24MM. Full year estimate</td>
</tr>
</tbody>
</table>

Figure 3.2
Bulletin Board
DB pictures_2
MATERIAL REDACTED AT REQUEST OF UNIVERSITY
1. Do not use a Low Value Order to hire off shore personnel.
2. Requisitions shall not be split to bring them within the limit.
3. All quotations (including verbal) to be recorded on the order.
4. Do not use against a Framework Agreement

**Limited Low Value Order: FS**

Subsidiary of: [null]
Tel: (01483) 292220
Fax: (01483) 292144

Buyer: Barry Brown

Item(s) Requisitioned By: [null]
Deliver To: [null]
Approval Manager: [null]
Buyers Comments / Quotation Ref: [null]

Status: Ready For Approval
Status Changed By: Barry Brown
Delivery Date: [null]
Date Received: [null]

Order Date: 06/12/96

This number must appear on all invoices, packages, shipping & correspondence

Figure 3.4
Low value orders new document
LVO_pictures 1.1
Warning to Supplier: If the Total Value of this Order exceeds £5,000 or its equivalent value, then this Order cannot be paid under control procedures - refer back to the Buyer and do not proceed with the Order. Do not accept split Orders for the same service.

Payment Terms:
For Goods Only: Pay within 30 days of receipt of invoice
Delivery Terms: Subject to the Terms & Conditions "93JH015" attached to this order.

Acknowledgement of Order:
Please sign and return copy of this document for attention of the Buyer as above. Doing so will register the Order for follow-up payment.

Please type in the name of the requisitioner.
A sample of some of the Notes databases used at Narajo. This sample has been chosen to indicate the variety of databases used.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action Request Log</td>
<td>Allows staff to request repairs and maintenance of equipment. Repair men use it to check what jobs are outstanding and sign off completed jobs</td>
</tr>
<tr>
<td>Oracle updates</td>
<td>Used to keep track of the updates done to various parts of the central ORACLE financial computer system, how successful they were and what problems were encountered</td>
</tr>
<tr>
<td>Diary</td>
<td>Used to keep track of the dates which staff in certain departments will be outside the office</td>
</tr>
<tr>
<td>Company Notice board</td>
<td>Notice board for events happening within Narajo</td>
</tr>
<tr>
<td>Soft file</td>
<td>Used to store reports and documents for later use by the IS department</td>
</tr>
<tr>
<td>Joiners and Leavers</td>
<td>Used for the process of adding new employees to Narajo Oil or for recording leaving employees</td>
</tr>
<tr>
<td>Local Orders</td>
<td>Used for the process of purchasing something locally within the IS department</td>
</tr>
</tbody>
</table>

Figure 3.6
List of databases

Page 81
Action Request Log
Record of Problem
(For Guildford Use Only)

Name : Ron Vaz
Ext No : 292221
Room No : BG05
Time Reported : 27/11/96 16:59:28

Category : (Press enter for the list) Rubbish
Location : (B210, BG15 or nearest to..) Computer Room
Brief Description : (enter one line only) Dispose of crates

Detailed Description : (giving some idea urgency)
Dispose of wooden crates - too heavy for cleaners

Date Required : (Press Enter for list to indicate level of urgency) Next week

For Admin Use Only
Current Status : NEW
Log Number :
Priority : NO PRIORITY

Figure 3.7
Action request Log
DB35

Page 82
<table>
<thead>
<tr>
<th></th>
<th>Ref</th>
<th>Who</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1992</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>92.001</td>
<td>Simon Robertson</td>
<td>Central Graben</td>
</tr>
<tr>
<td>5</td>
<td>92.002</td>
<td>GAPS - GECO - Prakla</td>
<td>Southern North Sea</td>
</tr>
<tr>
<td>6</td>
<td>92.003</td>
<td>Geochem Group</td>
<td>CNS/South Viking Graben</td>
</tr>
<tr>
<td>7</td>
<td>92.004</td>
<td>Simon Robertson</td>
<td>Southern North Sea</td>
</tr>
<tr>
<td>8</td>
<td>92.005</td>
<td>Simon Robertson</td>
<td>North Sea &amp; Adjacent</td>
</tr>
<tr>
<td>9</td>
<td>92.006</td>
<td>GAPS</td>
<td>Central North Sea</td>
</tr>
<tr>
<td>10</td>
<td>92.007</td>
<td>Geostrat - Badley Ashton</td>
<td>Central Graben</td>
</tr>
<tr>
<td>11</td>
<td>92.008</td>
<td>IEDS</td>
<td>Central North Sea</td>
</tr>
<tr>
<td>12</td>
<td>92.009</td>
<td>IEDS</td>
<td>Central Graben/Mid NS Hi</td>
</tr>
<tr>
<td>13</td>
<td>92.010</td>
<td>Simon Robertson</td>
<td>Central Graben</td>
</tr>
<tr>
<td>14</td>
<td>92.011</td>
<td>Simon Robertson</td>
<td>North Viking Graben</td>
</tr>
<tr>
<td>15</td>
<td>92.012</td>
<td>Simon Robertson</td>
<td>UK Continental Shelf</td>
</tr>
<tr>
<td>16</td>
<td>92.013</td>
<td>BGS</td>
<td>West Scotland</td>
</tr>
<tr>
<td>17</td>
<td>92.014</td>
<td>Simon Robertson</td>
<td>West of Britain</td>
</tr>
<tr>
<td>18</td>
<td>92.015</td>
<td>Geostrat - Badley Ashton</td>
<td>Outer Moray Firth - CNS</td>
</tr>
<tr>
<td>19</td>
<td>92.016</td>
<td>Simon Robertson</td>
<td>North Sea</td>
</tr>
<tr>
<td>20</td>
<td>92.017</td>
<td>Reservoir Research Ltd</td>
<td>Central North Sea</td>
</tr>
<tr>
<td>21</td>
<td>92.018</td>
<td>BGS</td>
<td>All</td>
</tr>
<tr>
<td>22</td>
<td>92.019</td>
<td>Halliburton</td>
<td>All</td>
</tr>
<tr>
<td>23</td>
<td>92.020</td>
<td>Geochem</td>
<td>Inner Moray Firth</td>
</tr>
<tr>
<td>24</td>
<td>92.021</td>
<td>GAPS</td>
<td>Netherlands</td>
</tr>
<tr>
<td>25</td>
<td>92.022</td>
<td>SSI - BGS - Nat Hist</td>
<td>UK &amp; Netherlands</td>
</tr>
<tr>
<td>26</td>
<td>92.023</td>
<td>GAPS</td>
<td>UK Southern North Sea</td>
</tr>
<tr>
<td>27</td>
<td>92.024</td>
<td>Geochem</td>
<td>Forth Approaches</td>
</tr>
<tr>
<td>28</td>
<td>92.025</td>
<td>Geotrack</td>
<td>Forth Approaches</td>
</tr>
<tr>
<td>29</td>
<td>92.026</td>
<td>IEDS</td>
<td>Central Graben</td>
</tr>
<tr>
<td>30</td>
<td>92.027</td>
<td>Reservoir Research Ltd</td>
<td>South Viking Graben</td>
</tr>
<tr>
<td>31</td>
<td>92.028</td>
<td>Paleo Services</td>
<td>East Irish Sea</td>
</tr>
<tr>
<td>32</td>
<td>92.029</td>
<td>Erico</td>
<td>West of Britain</td>
</tr>
<tr>
<td>33</td>
<td>92.030</td>
<td>IEDS</td>
<td>East Irish Sea</td>
</tr>
<tr>
<td>34</td>
<td>92.031</td>
<td>SSI</td>
<td>Wesssex Basin</td>
</tr>
<tr>
<td>35</td>
<td>92.032</td>
<td>Paleo Services</td>
<td>English Channel</td>
</tr>
<tr>
<td>36</td>
<td>92.033</td>
<td>Royal Holloway</td>
<td>General - Modelling</td>
</tr>
<tr>
<td>37</td>
<td>92.034</td>
<td>Lexis</td>
<td>North Sea</td>
</tr>
</tbody>
</table>

Figure 3.8
Lists
L10
<table>
<thead>
<tr>
<th>Code</th>
<th>Who</th>
<th>What</th>
<th>Topic</th>
<th>Start</th>
<th>End</th>
<th>Annual</th>
<th>Total</th>
<th>Status</th>
<th>Cost</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>91.001</td>
<td>Durham University</td>
<td>MSC Student</td>
<td>Devonian Reservoir Properties</td>
<td>Sum 90</td>
<td>Sum 92</td>
<td>15,000</td>
<td>30,000</td>
<td>* In progress</td>
<td></td>
<td></td>
</tr>
<tr>
<td>91.002</td>
<td>Oxford University</td>
<td>General support research</td>
<td>Computer Equipment for Basin Studies</td>
<td>May 91</td>
<td>May 91</td>
<td>5,000</td>
<td>5,000</td>
<td>* Lump sum donation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>91.003</td>
<td>Oxford University</td>
<td>Research group</td>
<td>Seismic Studies</td>
<td>Sum 91</td>
<td>Sum 98</td>
<td>150,000</td>
<td>1,200,000</td>
<td>* In Progress - reports to 4EPT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>91.004</td>
<td>Roy l Holloway &amp; Bedford</td>
<td>Research Association</td>
<td>General Support</td>
<td>Sum 91</td>
<td>None</td>
<td>1,000</td>
<td>1,000</td>
<td>* Annual support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>91.006</td>
<td>Herriott Watt</td>
<td>Commercial potential</td>
<td>Automated Core Analysis</td>
<td>Sum 89</td>
<td>Sum 94</td>
<td>20,000</td>
<td>60,000</td>
<td>Rejected cost £20,000 per year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>91.006</td>
<td>Exeter University</td>
<td>PhD</td>
<td>Wyth Farm Reservoir Diagnoses</td>
<td>Sum 91</td>
<td>Sum 93</td>
<td>7,610</td>
<td>15,220</td>
<td>* In progress</td>
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**Figure 3.8**

Lists

L5

Page 86
Chapter Four: Making Software
The social aspects of software development
4.1 Introduction

As a participant observer within an IS department, much of what I observed at Narajo was the process of software development. This provided an ideal opportunity to study both software development with Notes, and how software development in Narajo was arranged.

Although at its heart development is the writing of instructions for a computer to follow, this description ignores most of the work which goes on in software development. At the point where the program code comes to be written, much of the work has already been done. Resources must be mobilised before the programming can begin, in the form of money to pay for the development (programming at the very least requires a programmer and a computer). Some sort of description, or concept, of the system is needed. Getting that outline, and improving it is, in turn, dependent on access to "the work" to be assisted by the computer. That access might be of very poor quality, but if it is unavailable design decisions are going to be harder (if not impossible) to make. At the other end, if a computer system is going to be used, it needs people who are potentially going to use it — a userbase. That userbase may change as the project progresses, but there is the need for at least a potential audience. All these agents must be mobilised to make software development possible.

This chapter investigates this activity, discussing the social aspects of programming. That is, the tasks and actions which are part of software development but which are not concerned with merely instructing a computer what to do. The IS department at Narajo was a separate organisational entity from other departments, and development activity was pursued by seven individuals within that department. One cornerstone assumption of IS is that there are two different types of computer operation: software use and software development. Software development is taken to be the creation of software (of all shapes and forms), an activity which is self-evidently different from software use. However, this division is not pre-ordained from on high but instead is created by the way IS development is arranged. The chapter starts by comparing development of software in Notes with the development of spreadsheets, showing how the divide between use and development is actively produced.

This division is one part of the construction of "software development" as a coherent organisational activity. A second part is the location of development in its own organisational unit. Debates over IS centralisation were particularly virulent in the late 1980s (Dearden, 1987). However, these debates in the main saw the decision as a rational economic one based around what was best for the organisation. Locating development in a central unit can also be seen as a strategy for establishing software
development in a stable, workable and well financed situation. That is, IS as a separate organisational unit is one of the ways in which "boundary maintenance" is done. These two different steps, creating software development and locating it as a separate organisational unit are "making software development", producing a clearly defined activity and locating it in an organisationally secure position.

The second part of this chapter addresses how staff managed the day to day job of development and the problems that they needed to overcome in getting that work done. Although both social and computer scientists have been concerned with methods of software development, there has been little attention on the day-to-day details of how it is done. One major problem to be overcome by the development staff at Narajo was the need to get some sort of handle on "who the users were". During the development process, design decisions have to be made and developers needed a notion of "the users" so as to be able to make those decisions and defend them when challenged. 'User proxying' was one device used to achieve this. That is, people or materials were used as a 'proxy' to stand for the mass of users. The individuals or materials could be consulted instead of the difficult (and sometimes impossible) task of going to the users themselves. The notion of the user was thus an entity constructed by developers using proxies, helping them make decisions. Proxying was a "members device" for dealing with design decisions (Garfinkel, 1967).

A second issue which will be discussed is how the development of software depended upon agreement between members of staff. During design meetings documents took on an important role as devices in helping to achieve consensus. For example, documents could be used to "close off" discussion by getting individuals to approve a particular document. One document in particular, the requirements analysis document, was useful for this purpose. Although much care went into its production, it was only used once later on in the project, and then as a device to allocate blame. This document was more of a device for closing design decisions than determining design.

Some writers have suggested that ethnography could be incorporated more into the software development process, used to improve requirements or system testing. This discussion shows that while ethnography can be a useful "proxy" for the users in the development process, it must also be convincing, in that the documents should help to close off design decisions, convincing others in the design process. This underlies the role which quantitative data can have in design.

Lastly, the importance IS staff attached to appearing professional is discussed. As a member of IS it was important to maintain relationships with other individuals in the
organisation. Part of this was the maintenance of professionalism. Professionalism was important in convincing other departments of IS’s organisational worth, and the competence of the staff within it. Looking at deviations from professionalism, and how they were dealt with, highlights the way in which professionalism was an important part of doing "good IS".

4.2 Studies of software development

Despite the importance of software development to Computer Science there have been surprisingly few empirical studies of the software development process (Murray, 1993; Suchman, 1994b). While there has been considerable attention devoted to the method of software development by both social and computer scientists, this research has often limited itself to discussing these methods without considering the actual day-to-day practices of software developers (Murray and Woolgar, 1990). Most studies which have looked at development empirically have focused on the programming task, studying it from a psychological perspective under controlled laboratory conditions. This means that much of the social and organisational work around development has been ignored.

Amongst the few studies that have looked empirically at software engineering outside the laboratory there is a clear divide between those originating from a computer science perspective and those from sociology. Computer science papers concern themselves with giving advice to practitioners, and as such they can be somewhat naive to the sociological eye. Papers such as (Scacchi, 1984; Curtis, Krasner et al., 1988; Potts, 1993) while providing interesting studies, have very little theoretical sophistication, and no reference to sociological issues. For example, in the paper by Curtis et al. there is a discussion of "respondent bias" with no reference to the discussion of this topic within sociology, nor the problematic nature of this concept (Gilbert and Mulkay, 1982; p227, Hammersley and Atkinson, 1995).

On the other hand, much of the research from a more sociological direction has been concerned with labour process theory and the relevance of Braverman’s writings to the management of software development (Braverman, 1974; Kraft, 1977; Greenbaum, 1979; Smith, Knights et al., 1991). As the sociology of work was subject to the 'detail critique' in the last chapter, so can these studies. The actions of software development are seen through a prism of sociological values, and in doing so the details of software development are lost. Kraft’s study of programmers (Kraft, 1987),

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24(Davies, 1993) is a somewhat uncritical review of this work.
for example, while describing how development was arranged by management, fails to describe any details about the actual job of software development.

More recently there have been some attempts to develop a constructivist view of software development. Constructivist views originate from an approach known as the "social construction of technology" (MacKenzie and Wajcman, 1985; Bijker, Hughes et al., 1987; Low, Johnson et al., 1996). This is an attempt to study the form of technology through looking at the social and cultural circumstances of its production and use. It argues that technology does not have its own 'trajectory' but that its development is a product of the social situation surrounding its production. For example, that refrigerators are electrically rather than gas powered was a product of the financial situation of various hardware companies at the turn of the century, rather than the superiority of the electrical product (MacKenzie and Wajcman, 1985)25.

One of the best examples of this applied to software development is Knight and Murray's book *Managers Divided*, a study of system development in the insurance and finance industry (Knights and Murray, 1992). Knights and Murray state from the very beginning that they see computer systems as "not mere technical achievements but effectively social constructed by those involved in their making" (page xvii, ibid.). This leads them to look in depth at the role of organisational politics in the development of computer systems. They highlight the political relationship between IS and the rest of the organisation as an important issues for IS staff. Since they need to be able to get detailed business knowledge from users (so as to build workable systems) they depend upon staff. However, they also need to defend their own professional boundaries. This dilemma is exacerbated by the often problematic nature of IS development, where projects are often late in being completed, and resources can be scarce.

While the book presents interesting case studies, its approach has some limitations. Most importantly, the book is still open to a variant of the detail critique. Although we have stories of the politics surrounding the development of actual systems, the actual work of software development is ignored. The focus is more on the management of IS than actual development – an analytic distance is maintained. This can be compared with a paper such as Button's study of photocopy engineers (Button and Sharrock, 1994), where the practices of software developers are described in some detail: there is a close examination of how software development work is done in a

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25 The social construction of technology has its roots in the sociology of scientific knowledge (SSK). In SSK there was an analogous move beyond the assumption that science had its own inbuilt trajectory. SSK is discussed in more depth in chapter five.
certain way so as to fit organisational contingencies. Button and Sharrock discuss how a development methodology, while it gave better quality programs, was abandoned when the organisational priority for the project became one of speed, rather than quality. This kind of 'day-to-day' detail is absent from Knights and Murray's work, perhaps due to their use of interviews rather than participant observation.

A second problem is that while Knights and Murray explicitly commit themselves to a social constructivist viewpoint there is actually very little examination of the "construction" of software development. They take for granted many of the divisions and assumptions of IS staff. This makes the constructivist element of their analysis somewhat tame. For example, they do not question the fact that IS work is distinct from the work of other company staff. This 'construction' is not investigated. While it can be argued that constructivist analysis must make some assumptions (Sismondo, 1993), it is possible to develop a more wide ranging constructivist view of software development than they do.

4.3 The construction of software development

This chapter attempts to address both of these criticisms in its analysis of the fieldwork from Narajo. The first section looks more closely at software development and how it can be seen being constructed through the attempts of IS staff to maintain software development as a coherent activity. In particular, the way in which the development of Lotus Notes applications came to be seen as an "IS job" rather than something which could be done by users is discussed. The second section looks in more depth at one of the issues identified by Knights and Murray: the relationship between IS and other staff. In studying this issue there is an attempt to look at how agreement between staff is maintained in the day-to-day interactions of a software developer.

Software development has normally been assumed to be a straightforward, easily defined activity. Certainly in computer science, and amongst the programmers at Narajo, software engineering is a taken for granted term (Chapter one, Sommerville, 1997). Software development is, after all, something that can be easily identified. Although there may be some disputes over its scope, these are merely questions of definition. The straightforward definition of software development is that it is the work of programmers developing software.

But this would be to ignore the work which goes into 'defining' software development. That is, software development can be seen as a contingent concept. The definition of what is "software development" comes from how staff talk about, consider, and
protect, different activities. It is *produced*, rather than being pre-defined. Defining one activity as “development”, and another as “use” is utilised to produce a straightforward division of labour between other company staff and company IS personnel. That this distinction is so easily made is a sign of how successful this division of labour has become. A successful IS department establishes a clear division between *computer use* and *IS jobs*. This institutionalised division keeps IS viable as an autonomous department by maintaining its boundaries, maintaining an ‘obvious’ division between software development and use, and preserving software development as an IS task\(^2\). This is the creation of a ‘natural division of labour’ (Friedson, 1986; Anderson, et al., 1989).

### 4.3.1 User Development and IS departments

Spreadsheet development and the issues regarding its status as a valid “user job” demonstrate this. A good case can be made for spreadsheet development as a standard software department task. Spreadsheets are financially critical, often used by a large number of users, and make use of complex programming features. However spreadsheets are almost universally designed, implemented and maintained without IS support, by non IS users (Nardi and Miller, 1990b). This was certainly the case at Narajo where spreadsheet development had been institutionalised as a "user" job. It was expected that users develop their own spreadsheets, with little support from the IS department, other than installing and updating the spreadsheet application.

This division of labour was made rather than something which was pre-ordained. Spreadsheet development is not 'naturally' a staff job, but rather is something which has come about through the actions and decisions of IS staff. This can be seen by comparing spreadsheet development with development in Lotus Notes. Developing a database in Notes has similarities with spreadsheet programming in that it shares two characteristics which have made spreadsheets particularly successful as an environment for user development. Spreadsheets offer a highly ‘visual’ programming environment in that all the major elements of design, such as cells and formulae, are visually represented. To change a formula you click the mouse and type a number, making development largely a process of “direct manipulation” (p85-92, Nardi, 1996). Notes, in a similar way, has a visual development environment where features of particular databases can be seen on screen and modified by mouse clicks.

\(^{26}\)This issue is slightly complicated in that IS (at Narajo and in other companies) also took care of the maintenance of software and computers. In this chapter the scope has been limited to just looking at development, but the same analysis could be applied to computer support.
In addition, spreadsheets offer a *double level language*, in that programming can be done on one level, with arithmetic formulae, or another with sequences of commands which resemble traditional procedural programming. The learning curve between these 'levels' is smooth because more and more complex formulae can be used until at some point a transition is made to using commands. Indeed, a spreadsheet's functional nature allows many elements of procedural languages to be calculated with formulae, postponing the need to move levels. An example of this is the 'sum' command, which sums a range of cells in a spreadsheet. In more traditional programming languages this would be done using a for-loop, a concept which can prove troublesome for novice programmers (Nardi and Miller, 1990a). Notes uses a similar dual level language, in that its programming language can be used in the form of simple formulas, or for more advanced programs which resemble procedural programming.

With these similarities one may think that Notes development could sensibly be thought of as a user task, like using spreadsheets. However, Notes databases are also similar to traditional databases, development of which has been strictly controlled by IS departments. Development in Notes, then, can be seen as potentially either a user or an IS job. At Narajo, this led to some conflict. IS staff saw Notes development to be an IS task, since it involved the development of “applications” — databases, which could potentially be used company wide. However, the nature of Notes meant that it was possible for users to develop their own databases, as with spreadsheets.

One staff member had developed a number of applications for her own personal use, such as keeping track of mobile phone numbers. This employee had encouraged another, M, to develop a name and address book in Notes to keep track of her contacts for the Narajo Coal group which she worked in. This allowed M and a co-worker to share contact information, even though her co-worker was based in Australia. By developing this application, M was able to manage a shared resource for both her and her co-worker, as they managed the buying and selling of coal. This "Coal Contacts" database kept track of all the people they would need to contact in their job, but unlike a standard name and address book, the coal contacts database also contained various personal details. Each record had a field to explain how that person had been contacted, personal details and if they received a Christmas card:

M: It hasn't had full approval from downstairs [in IS] as it's not very tidy...
   (laughs)
B: What do you mean its not very tidy?
M: I mean, our database... when we... see, we have lots of things on here which are standard. But when you come down (looks at database) here we have knowledge, personal and Christmas card... which is not terribly
professional... but knowledge, we like to know how they were contacted. whether they had gone through another company, another person, how we got hold of them. Information is... 'this bloke's a prat'

B: Do you really write things like that?
M: Yeah... because it's a protected database. But you have to sometimes... cos you have to know who you're dealing with, and if one of us has had contact with someone, and the other hasn't it's a handy way to say something to him, or watch so and so. It's cut and thrust. And personal, husband and wife, children's name... personal, so you can say: "how's stella". And that's the sort of thing they call not tidy

(133)

Although the coal contacts database had been placed on a shared server by the IS department it was not approved of by IS. As one IS staff member put it:

“If they’re developing applications the question is... why aren’t they doing their job? It’s our job to develop software.”

(Misc12)

IS Staff appeared to have an attitude that user development was a transgression into what was “our job”. Notes development was something which IS saw as a natural IS activity, with some resistance from users who saw developing applications as something they could do. This was a conflict over what is “development” (something IS do) and what is “use” (something users do).

During the research for this report, the version of Lotus Notes was upgraded from Version 3 to Version 4. In keeping with technological fashion Notes became much more oriented toward the Internet and the world wide web (Roberts, 1996). The move to Version 4 of Notes was particularly dramatic in the changes to the interface to the development parts of Notes. Developing in Notes is now much more like other dedicated development systems such as Microsoft’s Visual Basic, and less like that of spreadsheets. This new version of Notes was delivered to staff at the end of my time studying Narajo and end users who had previously developed in Notes now found that most of the simplicity had gone, being replaced with a complex collection of different options. While the resulting changes also increased the power of Notes, there was a corresponding drop in how easy it was to program for the novice.

In making these changes, Lotus seems to have adapted to the requests of IS professionals. An article in the influential computer professional’s magazine *Byte* presented a “wish list” from Notes developers and managers (Dobson and Andrews, 1995). Many of these ‘wishes’ involved making the development environment more sophisticated (and more complex). Improved user development was not amongst them. It is perhaps the case that since Lotus sells Notes mainly to IS departments
rather than to end users, features which are resisted by IS - such as end user development - are unlikely to help sales.

This conflict can also be seen in the context of the role Notes plays in wider conflicts between IS departments and other parts of the organisation. Turrell offers a survey of a study of 50 companies using Notes (Turrell, 1995). Each site was investigated by undergraduate students using a mixture of interviews and surveys. Turrell describes a “battle” in which “business would reclaim IS from the IS professionals”, with Notes as their weapon. This "battle" can also be seen in other research (Davies and Mitchell, 1994; King and Iacono, 1988). Davies and Mitchell discuss one firm in which the IS part of the firm had created a separate technical discourse with different rationales from those of other groups in the company, this discourse used to promote technology over other investments. Likewise, Kling and Iacono discuss the ability of technocrats to build support behind investing in technology. These papers contain evidence of conflict between IS departments and other staff, as do (Gasser, 1986; Brown, 1995).

Notes becomes involved in this conflict in the issue of who controls software development. This is a power struggle between ‘business’ and ‘IS’ over the control of the means of software production, with action rationalised in terms of “poor user databases” or “better designed user databases”. This theme is also played out in a magazine article on Notes (Bray, 1995) which includes a picture of one manager with the quote “We’ve always known with a database that we can control it” underneath. This article also describes the desire for “a client version of Notes” which removes users' ability to develop their own software.

At the heart of these debates is the question of what is naturally an “IS Job”. Like any organisational unit IS has a problem to define what is and is not its own responsibility. One way of doing this is the definition of a given job as “naturally” development or use. Tasks must be recognisable as "updating the software" (an IS job) rather than "changing a user option" (a user job). Using a word processor must be clearly distinct from programming a computer, or otherwise the boundaries of IS will become leaky. This "boundary maintenance" (Star, 1988) is not always helped by technological advances. Technologies may emerge which could disrupt the division of labour. These advances must be resolved and the proper responsibilities decided upon. This is a battle over definitions, and a battle over who controls the means of software production. Software development is the "crown jewels" of IS, since it involves

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27 These quotes are altered slightly since Turrell uses the term IT (information technology) rather than IS (information systems)
considerable resources, committed over a long period of time. Accordingly, it is in the interests of IS to monopolise this activity and for it to be considered an "IS job".

The end user development of spreadsheets has led to the creation of original applications which would have been unlikely to develop if it had been made into a IS task (Nardi and Miller, 1990a). Indeed, some writers have gone as far to suggest that spreadsheets were behind larger changes to the way organisations work (Levy, 1989). Along with this, there are many arguments that end user development can lead to better software (Guimaraes, 1984). If Notes was allowed to be an active end user development environment, it is likely that it could have similar effects. Many of the databases developed by end users at Narajo, while very useful to the staff, would have been too trivial to have been developed by IS. This sort of small application is lost in an environment where IS monopolise development. That is, a whole class of computer applications are being lost by the monopolisation of development by IS. Unfortunately, recent versions of Notes have moved away from catering for user development, and Notes is now advertised as a tool to be used by IS for “inter/intranet development”, rather than as an environment for end user development.

4.3.2 Rational arguments

It is important to emphasise that the argument here is not that if one group obtained a monopoly on these tasks this is necessarily a bad thing for an organisation. With IS centralised in one part of an organisation it is easier to control what is done with computers. Accountability rests with one department, hopefully engendering a concern for quality. With knowledge centralised, software development can be restricted to professionals with the proper training. Standards, both explicit and implicit, can be set (preventing the dangers of multiple standards) and resources globally managed (Friedman and Comford, 1989).

The question here is not whether centralisation or decentralisation is better, rather, that the particular arguments for the actions of IS - while plausible - disguise the fact that the actions of IS departments also help IS departments to survive. With regard to questions of user development, for example, the IS professionals at Narajo would refer to the bad quality of software which had been produced by users in the past. While it was true that the IS department would often be called in to help once user development projects had gone wrong, this response neglected to compare end user development with IS run projects which had also gone wrong. Questions of the arrangement of software development are not decided on a purely rational basis but are instead enmeshed in the political reality of organisational life - one part of which is the need for IS to protect and maintain itself organisationally.
An example at Narajo was the IS department's 'standard build' on its computer system. This was almost a retrofitting of the standard Windows operating system, with various checks being run every time a computer was turned on for viruses and non standard programs. This process took so long staff joked about turning their computers on in the morning so they could use them in the afternoon. But as well as being useful to IS in terms of updating software, preventing illegal software, software viruses and such like, it turned every otherwise autonomous PC into an extension of the IS department. With this 'standard build' IS had cemented their control over the computers at Narajo, making the IS department central to even the most elementary computer use. While this centralised build could be rationally justified, it also served to further the role of a centralised IS department. Sensible stepping stones like these served the purposes of the IS department.

4.4 Doing software development

4.4.1 Evolutionary Development at Narajo

The investigation now moves on to how software development was done at Narajo, and in particular the social and organisational work involved during development. Studying this shows what sort of 'social work' is involved in software development. Development is not merely the technical co-ordination of the correct lines of code at the correct time, since it takes place inside an organisation and involves the interaction with various colleagues so as to be able to get the job done.

Development at Narajo was evolutionary or exploratory development (p10-12, Sommerville, Rodden et al., 1992), a form of development in which the design is changed throughout development to respond to feedback from the users. This model of development is distinct from the so called “waterfall model” where there are fixed points during development for users to comment on and contribute to the design of the system.

With Notes, changing a system while it is in use is easier than with most other development systems. During development it was possible to release prototypes to interested parties and incorporate their suggestions into the final product. This made interaction between the user representatives and the developers an ongoing part of the project. The user representatives had a considerable role in the management of the process of design and development themselves. Another difference between Narajo and classic software development was that the groups of programmers involved at Narajo were also very small, for example only two programmers worked on the

28 That the user representatives and the users were not the same thing is something returned to later.
timesheet system. This is very different from the large team based software development which produces products like Microsoft Word. Since the problems of co-ordination increase as the number of participants in a development project increase, large groups have been a major focus for software engineering research (Murray and Woolgar, 1990). Although there were problems of co-ordination between the programmers, the main concerns at Narajo were dealing with the user representatives - managing, as it were, "the users".

While studying Narajo, the main project I worked on was the electronic timesheets system - nicknamed "timewriting". This system was designed to replace an existing paper process for measuring the time staff worked on various company projects. Staff had previously completed an account of their time on paper "timesheets", and this system was now to be computerised into a Notes databases. The project team for timewriting consisted of two programmers, two representatives from the finance department, and a manager from IS. This was a fairly close team, with meetings every week to discuss how the project was progressing, and prototypes frequently 'released' for comment. Throughout the project the design changed to take in contingencies such as finance staff changing their minds about the design, or a proposed solution being too slow for the current system.

This 'evolutionary' form of software development has not been a topic of much empirical research. The little empirical work which has been conducted on programming has focused on the classical "waterfall" method of development, and projects in which there are large numbers of programmers. This is not to say the evolutionary development method is unusual or rare. In the review of Notes users discussed in chapter 3, many users had some form of in-house Notes development, and that development took place in an evolutionary manner:

"I'll get three or four phone calls or emails a week and I'll take it from there. I go round to see the user, with whatever poor soul I think is going to do the database and we chat about what they want [...] But I find you have to get dirty very quickly. You have to show them what you mean. There's one old guy who just wants a nice application before he retires and you have to show him everything on the screen."

(ery/S)

4.4.2 Making The User: User Proxying

When designing a software system at Narajo, one of the most difficult problems which had to be overcome was to form a sense of who "the users" were, and in turn what their "needs" were. To produce good software, managers and staff emphasised that the users should be involved in projects as much as possible. Being responsive to users was an issue of some pride to Narajo's IS staff. Good software depends in part
on the "right" design decisions being made, and that in turn depends upon the needs and opinions of the end users. The staff at Narajo wanted to involve those users so as to be able to make better design decisions.

Unfortunately, even at Narajo where users were physically around the corner, there were a number of barriers to contacting users directly. This can be seen in one of my first meetings at Narajo. Although several users had been invited to the meeting I noted that:

No users turned up, although they were meant to. Just finance and IT people. (29/8)

My own manager would often curse about how difficult he found it to get users interested and involved in projects. Software systems were of central concern to IS, but they were something which could be ignored by other staff, busy with their own concerns, until they were forced to become involved. As the meeting progressed, I suggested that I could go and interview several of the timesheet users and approvers, to discuss with them their suggestions for the project:

Talk of me going and seeing the user. Financial thought might not be a good idea. "bitch session", "you might not get that much off them". K (IS manager) tries to smooth this over - "I'd want you to feel comfortable with the questions". Maybe we could check with them the topics to ask? A notes questionnaire [was suggested]? (29/8)

The finance staff appeared uncomfortable with the idea of me interviewing users about a finance departments' concern. Since the timesheets were considered something of a chore, it could be politically sensitive if someone from a different department came and started talking to them about this project. In a sense timewriters were "finance’s users", finance were the gatekeepers here. An additional practical problem arose in that it was difficult to find users in the organisation. For timewriting I had to get the finance department to print out a list of existing timewriters whom I could contact and ask to talk to. This sort of direct contact with users involved "cold calling" them - something considered quite unusual behaviour by my colleagues.

Even once one was in contact with users, the question of what their "needs" were not easy to discover. Users often had little concept of what was either possible with technology, or how this use would help or hinder their work. To an extent, needs are a prediction, since by saying users "need X", you are predicting that they will be better

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Grudin has discussed at some length the barriers to contacting users during development projects, discussing both commercial, as well as in-house, software development (Grudin, 1991).
off with X. Accurate prediction assumes the ability to consider the proposed solution - something which often only IS staff could do. Even when in direct contact with users, it is difficult to be sure that particular responses are representative. IS must resolve the conflicts between the needs of different users. In this way, needs inevitably came to be decided by IS, albeit with input from different users.  

Design discussions, however, were full of questions which needed to be "answered" by resort to "what the users need". Staff needed some way to form an idea of what these requirements were in a way that would be likely to produce a "good system". One device used to solve this was "user proxying". A small group would stand as proxy for the whole user base. In some cases they might not even be actual end users, but merely convenient staff members. With the timewriting system, the financial administrators of the system came to be considered 'the users' and questions were addressed to them. It was possible to obtain 'reasonable' answers from the proxy group without much work. The following extract illustrates this, when I tried to get some views on a particular design:

The refresh button: I changed the words "click here to refresh" to the standard Notes refresh icon. I wasn't sure that'd be obvious so I asked C [who sat next to me] as 'a normal user'. She said it wasn't [obvious] and she didn't recognise it as the refresh icon. She also pointed out that "refresh" was jargon too. But... she said she hadn't had any Notes training so she said you would probably find it OK if you had.

I went to ask M and we talked about it. He said he didn't know... it was the job of the users to say. "Ask V and D [the finance representatives] because they are the users"

(11/10.2)

In an attempt to get the view of "the users" on a design question I resorted to contacting the two finance representatives who were involved in the project. Throughout the project V. and D. stood for the users as a 'proxy'. Whenever the response of users was needed, V. or D. would be consulted, even though they were not actually end users. The staff at Narajo were aware of the fragile nature of this proxying, although on a day to day level proxies were "good enough" for making design decisions. Proxying allowed an unrealistic whole ('the users') to be reconstructed as a malleable sample (two members of the finance department).

User proxying was particularly useful for making the numerous small decisions (such as the layout of buttons or wording) towards the end of the project. At this point time

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Knights and Murray point out that user involvement in development is always asymmetric, since IS knowledge is localised in IS (p103-106, Knights and Murray, 1992). See also (Beath and Orlikowski, 1994) on this topic.
constraints made it difficult to go and contact actual users. Indeed, the constraints to contacting users were such that it would not have been worthwhile to contact them over these small issues.

4.4.3 The imaginary user

This proxying would be taken a stage further in design discussions when the notion of the 'imaginary user' would be used. That is, during design meetings 'the user' would be spoken about as if was an actually existing person. In these discussions a notion of the systems' eventual user came to be constructed, the construction of an 'imaginary user' (Bardini, 1995; Woolgar, 1991). This imaginary user was both a topic and a resource to staff in design meetings. Arguments took place over 'who the user really is' - such as their level of technical skill, or what they would want to do with system. Those involved in development claimed the right to speak for the user and to describe his or her situation. From these arguments, 'the user' came to be constructed, with characteristics such as level of skill, desire to do certain things, level of commitment to the project, and so on. Once this imaginary user was constructed, it could then be used as a resource - particular designs evaluated in terms of how well they 'fit the user'. The imaginary user was thus a concept which was continually contested and developed in design discussions.

One example of this was an argument during a design meetings over whether staff should be able to see each others' timesheets. This from my notes show some of the different resources which were mobilised when creating the user:

We can change the settings so that a timewriter can see all timesheets [...] this satisfies the needs of some people in finance to be able to see all the timesheets. Unfortunately, this also means that everyone can see everyone else's timesheet.

[1] V. said that while he had no problem with it, the issue had come up with the users when I had interviewed them.

[2] A. mentioned that this had been an issue with the holiday and training database, that you could see when someone else was going to be on holiday in the future and so the argument goes you could see when their house was going to be empty and break in. So an important issue here is visibility of [the] timesheet to other people. [...] 

[3] I said that the 'other people reading your timesheet problem' gave rise to 2 issues:

1) People might be reluctant to use the system - but apparently this is OK because G is going to be hassling them anyway
2) A higher up [manager] might not like this and put pressure on us to change it

[...]

[4] Eventually we came up with a solution which was to add a choice to each person as "move to extra views". On the basis of whether you are a manager or not I let you through. Alternatively they can sabotage it by using View Show Main Navigator, but it's an unlikely thing to do

(9/12)

The problem arose because a group of finance staff needed to be able to access all the company timesheets, something which had been missed from the implemented system. A simple solution to this was removing the access control on the timesheets, but this produced a problem because then the timesheets would be readable by everyone. V. suggests that this is not a problem to him, but that my interviews suggested that it would be with the users (1). V. is presenting himself as a user proxy then using the reference to the interviews as a resource to suggest what the users are like. A. then discusses a similar problem with another database (2). This is historical evidence to suggest that it would be a problem. I then follow through on the idea that users would dislike the open timesheets (3), and suggest that since G. is going to be forcing the users to use the system, it might not be a problem. Eventually a solution is accepted that depends on an acceptance that most users are novices and unlikely to use the "View Show" menu to get access to the timesheets (4). This is using the "imaginary user" as a resource to make a decision.

Different notions of the user may be used at different times to assert or establish the viability of certain design decisions, although those notions may in turn be contested. While the notion of the "imaginary user" was a useful device in discussions like this, it was fragile in that it was always open to being collapsed by an actual user. Systems are used by groups of different users, users who have conflicting needs and since the developers are attempting to speak for the users, actual users might diverge from their construction. This makes the concept something of an ad hoc device, rather than an established part of any design methodology. This notion of “what the user is like” is not completely flexible. Arguments would turn on the “reasonableness” of given views, in that staff would attempt to establish a view of the user, making use of their experience, and often their prejudices, of dealing with users. Added strength could be given to arguments by displaying the thoughts or actions of an actual user, or history of how users had behaved in the past. The notion of “what the user is like” was then evoked in design discussions to help decide these issues “sensibly”.

4.4.4 Documents and agreement
The timewriting project involved considerable input from two members of the finance staff - they had been “proxied” as the users involved in this project. This close relationship meant that meetings were held nearly every week, with the aim of achieving some agreement on how the project was to proceed. At these meetings, design decisions would be made and confirmed, and documents discussed. As the project progressed, the design of the system changed considerably as a result of suggestions made both in these meetings and from other messages and documents distributed.

This close relationship with the user representatives made agreement particularly important. Agreement was essential for the project to progress, since if there was disagreement over what shape the system should take this could halt work. Design decisions were made on an ongoing basis throughout the project, with staff seeing early versions of the system, or reacting to technical problems which had arose during implementation. The design decisions made, however, were provisional in an interesting way. Often agreement would be reached on some issue, only to cause problems later when it was realised that the different parties had agreed to different things.

When we agree something we agree it "for all practical purposes" (Anderson et al., 1989). That is to say, we agree sufficiently to get what we want done in a practical and expedient way. However, as cases in the development of the timewriting system showed, often agreement would be made on some design issue, but later it would be discovered that the different individuals had quite different interpretations of what had actually been agreed upon. Bucciarelli in his study of an engineering design firm discusses how after a successful design meeting:

it emerged that different individuals had quite different interpretations of the significance of the choice of a 48-volt module even though the 'objective' engineering layout of the network of cells, diodes, and cell interconnections had been clearly sketched on the board ... Different participants had different interpretations of the implications of the image. They differed in terms of module performance, ease of assembly and fabrication, costs, customer appeal, and the like. (p118, Bucciarelli, 1988)

Bucciarelli’s point is that while the meeting had achieved agreement on an objective engineering diagram, the different parties held radically different interpretations. Agreement had been reached, but whether that agreement was “good enough” is something which would be decided by later events.

At Narajo there were many incidents of agreement being reached then later breaking down when it was discovered that different things had been agreed upon. Agreement
over design features in particular would often break down when the design became embodied in a more concrete form. For example, the design of the timesheet called for a message to be sent to the author of a timesheet if the timesheet had been rejected. The author could then, presumably, correct their timesheet and resubmit it. However, there turned out to be a subtle difference between the implementation and what the finance representatives wanted:

When a timesheet is rejected that has been prepared on behalf of someone else, the E-Mail that is sent back tells you that your timesheet has been rejected. It is not until you open up the timesheet that you realise it is the one prepared on behalf of another person. Would it be possible to have the e-mail insert the person’s name whose timesheet has been rejected in this case?

(extract from email message 26/11 GR)

If a timesheet was completed on behalf of someone else, and it is rejected, they wanted the computer to be notified that the timesheet for that person has been rejected. The earlier agreement has been shown to be incomplete, since we had not considered this particular situation. Agreement was re-made based on this new functionality, and the project went on.

Documents

Documents had an interesting role to play in this process of reaching agreement, in particular the requirements analysis document. This document has a major significance in the classical approach to the software engineering lifecycle, as the document which specifies the complete design for the system before it is implemented (p51, Sommerville, 1997). At Narajo, however, this document was less grand, and more of a stepping stone used in the ongoing relationship between the developers and the users representatives. The requirements analysis document, along with other documents, came to be used as evidence of agreement with the users on design points. The document had been “agreed upon” as much as could be done at that point, and implementation could start. Rather than a representation of the future design of the system, the document was more a method of achieving agreement amongst the parties involved. It was a way of “closing” decisions and then moving on.

Indeed, the document was almost completely ignored after it was written, right until the end of the project. The finished system was very different from that described in the requirements document. As the design progressed, issues became obvious that had not been originally considered (such as how to prevent timesheets being approved for months in the future). Since the analysis document was not taken to determine the
design, these issues would be resolved in a design meeting and then implemented, with little concern for what the requirements document had said.

That the requirements document was not just used to guide design can be seen in an incident at the end of the project. Late in the project the user representatives (V. and D.) requested a major change in the security model, that is, who had access to what parts of the system. This was likely to require a major redesign and potentially could have delayed the implementation of the system. In this context, the requirements document was used as a device for shifting blame away from IS for this last minute "hiccup". The users had signed off incorrect requirements so it was 'their fault'. The requirements document was used not as a guide for the design of the system, but as a way of allocating responsibility and of defending the work of the IS department. Its creation was a method for achieving provisional closure on design issues and its later use was as a device for appropriating blame, and putting pressure on the user representatives to compromise in their design requests. In my notes from a design meeting, I noted how the IS manager used the requirements document as evidence that the change was the fault of the finance department:

K seemed annoyed that this hadn't been picked up earlier - they want a different security model now ... Keith asking why this wasn't in the original specification. (9/12)

The document thus put pressure on the users to compromise in their request and accept a less radical change to the system.

4.4.5 The murder mystery

As described above, one of the major problems to be overcome when developing software at Narajo was the need to maintain agreement. That is to say, design decisions must be made and design issues closed off, so they can be implemented.

Design, and software development is normally considered to be a creative process. A new artefact is born with functionality never seen before. While development obviously has its creative elements, the day to day development process at Narajo was also a murderous process. That is, when a project was first conceived there were many different possible features which could be in the final product. The final product had the potential to exist in many different forms. The major activity of design was thus not one of creating new possible features, but of killing off the possibilities until only a few survived. Development was a process of getting others to commit to the killing of the unsuccessful concepts, using devices such as requirement documents as accessories to the fact.
This is not to say that any idea could be arbitrarily killed off. The designers wanted to produce a “good system” (something very difficult to define) so they had to proceed carefully, closely examining different ideas and possible designs. This was the dilemma: the need to kill off ideas while maintaining agreement, and yet not eliminate good ideas or designs. The need to have as good a design as possible, yet not take forever in producing that design.

This sort of dilemma also be seen in Bruno Latour’s narration of the failed transport project Aramis. The engineers’ transport system fails, not because of a lack of originality, but of a lack of compromise:

Aramis has been exactly the same for seventeen years. The basic concept hasn’t undergone any transformation, any negotiation, except for the pair of cars and the ten seats. It’s held up against all comers. Yet you interviewed quite a few sceptics! Things have happened in the last fifteen years! (p281, Latour, 1996)

The transport system failed because the developers did not murder the concepts which would not be in the final design. To bring their invention to life, they needed to kill the different concepts of what Aramis could be so it became something that was. As part of the unusual style that pervades the book, Latour takes on the voice of the failed transport system and protests:

I would have been happy to be something, in the end, anything at all - but first you have to agree among yourselves. I can’t be everything to everybody. The finest project in the world can’t give more than it has, and what it has is what you give it. (p294, ibid.)

The developers, in their desire to produce a system of the highest quality neglected to make the decisions needed. While what is a “good system” is undefined, there is still a pressing need to actually make decisions. Another study of design, Moody’s (Moody, 1995) ethnography of an attempt to produce an children’s encyclopaedia at Microsoft, again shows that the difficulties were not in producing ideas, but in killing them off. As the project progressed, arguments raged over even the most basic design decisions. Eventually, it took a new project manager to break the logjam by taking what seemed to some to be arbitrary decisions in order to rule out potential designs.

The slightly macabre metaphor aside, the documents and messages during the development process can be seen as devices in the interactions during development used to close off design discussions. So rather than seeing the requirements analysis document as a description of what the system will look like, it can instead be seen as a prop to obtain some sort of consensus amongst the parties involved (In this case as an
accessory to murder). At a later date, the requirements document would be used to defend actions or demand compliance. The document changes in how it is used throughout the project. The document is a different device at different points - the document has a “career”. It is a complex artefact used in the ongoing process of software development, rather than a simple “representation” of the future system.

**Ethnography and the design process**

So, developers face a murderous dilemma. They want to include users' ideas into the project (through, for example, proxying), so as to improve the quality of the end product. But they also need to murder ideas so as to be able to get on with the implementation. They need their designs to be as “good” as possible (itself something undefined), hold consensus over design decisions and still kill off impractical ideas in as quick a way as possible. Balancing this is what stops the design process from being rushed. It is a precarious balance. Indeed, the timewriting system design - ongoing throughout development - took over four months from beginning to end.

Into this balancing act, some authors have suggested that ethnography can have a useful input. Particularly in the “requirements analysis” stage, an ethnographic study of how a job is done can provide useful data on how to design a system to support that job (Sommerville, 1993; Anderson, 1994). Some have suggested short ethnographies of the work to be supported can be useful (the so called “quick and dirty” ethnographies) (Hughes et al, 1994) providing feedback on proposed designs, or evaluating improvements.

The above discussion also indicates where ethnography could fit into the software design process. An ethnography can be used as a “proxy” for the users, in that the ethnography gives information which can be used to “stand for” the users, to help the efforts of designers to understand and come to terms with users in their design discussions. In fact, returning to the quote on page 102 from the design meeting, it is possible to see that V. refers to my interview data from the timewriting users. There the interviews (one part of the ethnographic data) are used as a proxy for the users, to indicate that they suggest staff would not like timesheets to be open access.

In this way the ethnographic documents, documents assembled to impart the viewpoint of “the user”, are used by developers in building the imaginary user. In this case it is only interview data which is used, but there is no reason to suppose that field notes, or transcripts of online discussions could not be used.

Indeed, the need to establish agreement on design decisions suggests one possible innovation to the conventional type of ethnographic data collected. For while ethnographic data may be an effective user proxy, there is also the need to establish
agreement on design decisions. As was described above, documents are used as an accessory to "murder" impractical possibilities, to help form consensus. Thereby the precarious balance between the practical and the impractical, the realistic and the ideal can be maintained. The question arises, would ethnographic data be sufficiently definite to convince other members of the design process that a particular design should be "murdered"?

User trials have conventionally addressed this question by using quantitative information which is then used to build a solid argument. Definite "numbers" are likely to be very convincing in establishing what is a better design. For example, in Moody's ethnography at Microsoft, staff used an end-user trial to establish a particular design feature. The user test was a way of objectively deciding a particularly contentious design issue by reference to 'objective' information. The trial closed off debate, killing other design possibilities. For this sort of activity numbers seem more useful than qualitative data.

With this observation, it is important to emphasise that there is nothing mutually exclusive about quantitative data and ethnography. Ethnography is an attempt to see the social world from the viewpoint of those participating in it. Although modern ethnographies are nearly exclusively qualitative, some of the early Chicago school ethnographies made use of questionnaire and statistical data. In using ethnographic data in the design process, perhaps a return to the methodological opportunism of the Chicago school would be productive.

Qualitative data can help to answer "what is going on" questions, and provide a proxy for the user, indicating new design directions or suggestions. For example, the last chapter suggested how there was little support for ad hoc data ordering in most database systems. Quantitative data could in turn be used to demonstrate this point in a less open ended form, enlisting allies. This also suggests one reason why quantitative data has been popular in user trials. What it looses in richness, it makes up for in its ability to convince.

What should be clear from this discussion is that ethnography cannot solve all the problems of the design process. It is not the design process, but instead something quite separate from it which inputs into design to help in the forming of "proxies" or the building of the imaginary user. The job of designing systems is itself an important yet separate job from that of producing an ethnography which can be input into design. This is a point which will be returned to in the final chapter where we explain why there is no "implications for design" in this thesis. Design, it is argued, is an activity which is separate from ethnography although that is not to say that they cannot help each other.
It has been suggested that ethnography can help the design process, in that it can provide a useful input into the proxying of the user, helping designers build and obtain a view onto what the user’s activity is, or how better to improve an existing design. A second observation was that data like this should also provide the facility to convince others regarding design questions. This is the “murdering” of design solutions, the need to reduce the design space through the design process. This is an important need for designers, as they attempt to progress with a project while maintaining consensus. The use of quantitative data as part of ethnography was therefore suggested, since quantitative data has the advantage of being more definite and harder to argue against than the more qualitative data traditionally used in ethnography.

4.4.6 Managing relationships: Professionalism

With all this work directed to getting agreement between staff, managing relationships with those involved is a delicate yet important part of developing software. At Narajo, it was important in design meetings that a level of respect was established between the user representatives and the IS staff. That is, it was necessary that the IS staff were competent and also, crucially, that they were seen to be as competent, professional individuals. Accordingly, the software developers at Narajo were continually concerned with the presentation of themselves, their colleagues and their actions as professional and competent. It was not enough to merely do a good job, one must also be seen to do a good job - this was the difference between competence and professionalism.

Within the sociology of the professions, the dominant approach has been one which looks at a profession as an institutional phenomenon. Professions are something that people belong to. The interesting question has been how it is that certain groups of employees - lawyers, accountants, nurses have established themselves as groups with protected conditions. For example, in order to practice accountants must legally be members of a professional institution (Macdonald, 1984). Membership of that institution is dependent upon the passing of certain exams, the gaining of professional qualifications, and so on.

However within the sociology of professions there has been something of a counter theme which studies professionalism as something people do. One looks to see how it is that professionalism is done, how it is ‘made’ or ‘achieved’ (p20, Friedson, 1994). This can be seen in classics such as *Men and their work* (Hughes, 1958) and *Boys in white* (Becker, Geer et al., 1961) and has been carried on by writers such as Friedson and Dingwall (Dingwall, 1976; Friedson, 1986). This contrast can be seen in
Macdonald’s study of accountancy (Macdonald, 1984). There he describes the actions of accounting organisations, and their members, to achieve professional autonomy. But we hear nothing about anyone actually “doing accountancy”. Compare this with Harper’s account of trainee accountants where professionalism is seen as an ongoing project for staff, something which is personally achieved as their careers progress (Harper, 1987).

The observations of software developers here concur with this view of professionalism as an *ongoing accomplishment* of professionals. Professionalism is achieved by explicit efforts by staff to manage their relations with users. Professionalism was the display of the fact that “you knew what you were doing”, “could do a good job”, “took the job seriously”, an essential part of being a software developer. Management, both within IS and outside, needed to be convinced that one was doing a good job. Since managers often did not have access to the details of your own work, the way one presented these details so as to demonstrate your professionalism was essential in being seen as competent and thus preventing any possible threats to your own position.

Moreover, for the department as a whole it was important to maintain the notion of professionalism. Presenting a good impression maintained the IS department's image, and thus influenced questions such as funding and headcount. The IS manager went to great lengths to complement one member of staff because he was “professional, and most of all he appears professional in front of the users” (misc14). Particularly during lunch this need to impress management could be seen. During lunch, joking would stop when a member of senior management joined the table and was replaced with more “high brow” conversation. Once the manager departed, the IS staff would appear to collectively breath a sigh of relief. One colleague described this to me as the “Stalin effect”. The story goes that Stalin’s standing ovations were so long because nobody wanted to be the first person to stop clapping. With lunch at Narajo it was similar - when a member of senior management sat down no one wanted to be seen as the first person to leave the table. In one incident, the managing director sat down with us at lunch. Everyone politely sat at the table and waited until he had finished except M, who got up and left. M had just that week handed in his notice and so was presumably past caring about how he presented himself with the managing director - unlike the rest of the staff.

Another incident shows some of the problems which a lack of professionalism could give to relationships with users. In one meeting early on in the timewriting project, we met up with D who was one of the finance representatives. I had met with my manager, M, before the meeting and we had worked out some rough timescales for the
During our discussions with D we began to juggle these timescales - since they were quite rough - as D suggested alterations to the project. From this D began to get very worried about how we were calculating the times. A very informal technique was being used - I would suggest a timescale, and M would double it. Obviously, to D this did not seem a professional way of calculating times:

After D saw how we were working out the timings for the development he got quite worried and put pressure onto us.

Our professional image had been dented by the ad hoc way we calculated the timings. The meeting broke up with a palpable sense of worry, and D expressing his need to be reassured about how the project was going to be run.

In an attempt to repair this, M and I worked on a more detailed timescales document which listed the time required to do each individual feature. Although the document was more detailed, the device we used to calculate the times was the same as in the meeting - I'd suggest a time and then M would double it. While this was of course a very rough algorithm, it seemed to produce figures with a big enough margin of error for us to be safe. The more professional looking document calmed some of D's fears and he gave his approval for us to proceed.

In another incident, M lost his temper at a member of staff, prompting a comment from G about his "professionalism":

Tempers frayed over a problem which had arose on Friday regarding the security of some IDs at GY. Apparently some people had been reading other people's mail files. Stopping them from doing this was going to involve re-authenticating their ID files. The main bust up, though, came between M and J. J had changed something in the system which stopped some users from accessing Notes and then went to lunch. M had to fix it and this meant that he was pissed off with J and shouted at him down the phone. G made an interesting comment (audible to the whole corridor, as had been M's call) that in his 20 odd years of professional working he had never heard anyone make a call like that. This made the point that was being unprofessional in contrast, without even saying it.

In this extract, M losing his temper became a point for being criticised by one of the more experienced department members, G. What was significant was that conduct was marked out for being "unprofessional" and something worthy of criticism. Staff did not normally operate in this way.

Indeed, on one works night out - M's leaving night - stories of unprofessionalism became a topic of much gossip. M's leaving night involved a traditional night out in
the local bars. Over a meal, the storytelling turned to stories of great unprofessionalism, and in particular the actions of two individuals who no longer worked at Narajo - A and B. A was a particularly young employee who had been given a job as part of a government training scheme, whereas B had been in the army before he came to work for Narajo:

B got into a situation where (for some reason) he didn't give a user his geological 'plot'. So the user sent an email to B's boss saying "he won't give me my plot". This then went on to S [the department head], who told him to go and give him his plot - which he did. Unfortunately, later on B met the user on the stairs and kicked the user in the leg causing him to fall all the way down the stairs.

Story about the YTS guy [A] who used to work [at Narajo], who thought he was "god's gift to women" but was described by J as "small and sad". Seemed like he got quite a hard time. Eventually they got him to go up to B and "give him some abuse". B went and forced A's head down the toilet. M was on the help desk and they were swearing at each other and M had to put his hand over the phone.

A week or so later, over lunch I made a comment about these incidents, but the reaction was rather different to that on the night out:

I made a joke about the chap who kicked the user. This didn’t go down well at all

Stories of unprofessionalism were of great interest in a situation of “time out” from the work - but while at work they were instead something not to be discussed, as they were examples of lack of professionalism. Telling these stories, staff emphasised the difference between their normal activities and those of A and B - staff did not do these sort of things, and although they were (in the right situation) a source of amusement, they were also a demonstration of unprofessionality.

Getting development to run smoothly depended upon this display of professionalism since without it, it would be difficult to get staff to commit to IS projects. A large part of the job of developing was convincing others to follow, and concur with, your own decision. A particular requested feature might be technically impossible, so require other staff to be convinced of this, and to agree with the dropping of that feature. The opinion of the developer needed to be respected for this sort of arrangement to work. Without a belief in what the developer says, without a trust in the developer as professional, this would have been very difficult. The developers at Narajo were not
only professional, they displayed themselves as professional, an important part of doing a good job.

4.5 Conclusion

Making software is a difficult job, a job which involves managing the relationship between development, the organisation and other staff. This chapter has focused on what might be called the social and organisational sides of this task.

That software development is possible depends on the clearing of an 'organisational' space in which IS can monopolise development. This involves software development being considered an activity in itself, distinct from software use. The job of software development is not something which is handed down from on high, but instead the product of arguments and disagreements over what is, and what isn’t, the job of IS departments. That the development of Lotus Notes databases at Narajo was “software development” is therefore not simply because Notes development is software development, but because it is produced this way by those in IS departments. Incidents where a user had developed their own application can be seen as “boundary transgressions”, where a user was doing something which had become defined as an “IS” job, leading to conflict. The point of this observation is not that this is an inefficient or undesirable way to develop software, but that this is not accidental.

Observing the development of the Notes timesheet system was an opportunity to investigate the methods used to help development proceed smoothly. Attention has been paid to the interaction between developers, users and managers. One key technique was the production of a notion of who “the user” was. At Narajo there were barriers to going to the users directly, as frequently as the project could require, and the users themselves were a diverse, difficult to contact and undefined group. Territorial questions could also arise because contacting the users directly could be seen as a transgression of department responsibilities.

These problems were overcome in two ways. Firstly, two staff members from the finance department came to stand for the users as a “proxy”. These staff members, while they would not actually use the system, were easy to contact and could be said to know what the individual end users would want and do. The staff from the finance department came thus to be considered as “the users” - being referred to as “the users” by the IS staff. This proxy was a useful and simple way to decide design decisions without the need to go to the users on an ongoing basis - the “proxy” could be contacted.

A second way of overcoming these problems happened during design discussions. Reference would often be made to “the users”, with the needs of an "imaginary user"
being evoked either for or against a certain design. “What the user wants” would be a
topic of discussion, constructing a notion of the user. This notion would then be used
as a way of arguing for different designs. The user came to be both constructed and
evoked to help make design decisions.

Managing the relationship with non-IS members of staff contributed to making
development proceed smoothly. The development of the timesheet system was
evolutionary, in that the design changed as development proceeded. These changes
came from decisions made in design meetings with the user representatives,
management and the developers. To the developers, and to the department as a
whole, professionalism was an important quality to present so to make these meetings
manageable. Convincing other staff of the validity of your viewpoint depended on the
appearance of professionalism. Maintaining this notion of competence was needed to
convince other staff both that the project was viable, the developers could do what
they said they could, and that the views of IS staff were valid. Professionalism, was
therefore an ongoing concern for members of the IS department. Looking at incidents
where professionalism broke down indicates how unusual these events were, and how
staff dealt with them.

This description of the software development process highlights a number of issues
which are hidden from the standard software engineering view of development. Here
I have underlined the interactional processes and to an extent the political processes
which were part of developing the timewriting system at Narajo. While obviously the
product of the system was computer code, the description here has been of the
interaction around programming which made this computer code possible.

The question arises of how typical this sort of work is. The development at Narajo
was perhaps unusual in that it was evolutionary, with the design developing
throughout the project. In addition, the small number of programmers working on the
system made interaction with the user representatives and management more
important than interaction between programmers. The point of this discussion,
however, has not been to suggest that all software development is like what is
described above, merely that the social process were an interesting and important part
of software development at Narajo, and may also be in other, perhaps organisationally
different, development projects. Development here has been examined for its social
elements. The ways in which problems were overcome, and the devices used, all
demonstrate the social organisational skills used in development projects.
Chapter Five: Arrows, mobiles and computer databases

An conceptual investigation of what computer databases do, and how they fit into organisations
5.1 Introduction

The notion of 'communication' has been central to many discussions of groupware. Within the CSCW field, two of the foundational works, Winograd and Flores (Winograd and Flores, 1986) and Suchman (Suchman, 1987) make use of it in their studies of technology. In Winograd and Flores' case, speech act theory is used to suggest ways of structuring communication with electronic mail systems. Suchman discusses the use of technology as a conversation, fashioning a critique against the prevalent cognitive-science conceptions of computer use. This metaphor continues in the more recent debates between Suchman and Winograd (Suchman, 1994a; Winograd, 1994; Suchman, 1995) over the role of 'structure' in supporting collaboration.

Less academic discussions of groupware systems have also used this notion. One of the most popular categorisation of groupware is that of (Johansen, 1988) who divides groupware into four categories depending on whether it is to be used for communicating across different times or different spaces. Communication is also a popular metaphor in discussions of technology use per se. Since McLuhan computers have been often been described as a new type of "media" (Wilson, 1989; Loperfido, 1993; Daft and Lengel, 1994).

However, while popular, communication is not the only way to conceptualise groupware. In chapter three, we briefly discussed how Notes could be used as a 'tracking application', to keep records. This is the traditional use of databases - as records of some aspect of the world. For example, one database used by the staff at Narajo held details of rooms booked by members of staff. This database, by representing the intended booking of rooms, helped Narajo staff to co-ordinate their meetings. It seems inappropriate to discuss this database in terms of communication. If communication was what was going on, then concepts of "audience" or "conversation" would be expected to be useful. Instead, the interesting issues were how well the database reflects what rooms people wanted to book, and what constraints the database put on how the bookings were made.

This chapter is an attempt to develop a different way of discussing the use of groupware. Rather than conversation, we develop and apply the concept of representation. That is, a Notes database is not looked on as a way of communication

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31 Under this taxonomy Notes is a "different place, different time" software package.

32 (Poster, 1990) is one example of an unsuccessful attempt to discuss databases as a form of communication. See chapter five for a discussion of this.
between staff, but rather as a way of building a representation of the world. Doing this brings out issues such as the relationship between 'reality' and 'database', and how a database constrains the account of the world it contains.

The first part of this question we will consider is how it is that databases represent reality. This is a version of a very old question: how does language 'represent' the world? One philosopher in particular, Wittgenstein, answers this in a way that is directly applicable to other types of representation, like computer databases. Wittgensteinians such as Lynch have argued that this directs us towards studying representation as an activity. This provides an interesting direction for an ethnographic study: how databases represent the world can be seen by looking at how they are used in particular work environments.

Lynch's argument leads to other studies of 'representing' that have been conducted in sociology, and in particular two writers: Steve Woolgar and Bruno Latour. The application of their writings makes up the body of this chapter. Woolgar's social constructivist view of scientific representations shows that representation, rather than a taken for granted phenomena, can be investigated as an "achievement". That is, the fact that something is taken to represent something else is the result of actions by individuals to establish that representation as valid. This is, to coin a phrase, the achievement of "Woolgar's arrow".

In addition, Latour's writing suggest why it is that representations are useful to modern organisations. Latour writes about "immutable mobiles" - the ability to transmit information from one setting to another. Latour shows how important this has been to the modern world. Looking at how databases do this leads us to consider their ability to formalise. Formalisation is behind the power of the immutable mobile, and in turn of databases. Lastly, some political aspects of formalisms are discussed, and in particular the debate between Winograd and Suchman over the formalisms of system designers.

5.2 What is a representation?

Representing is an activity so common that it seems almost trivial to draw attention to it. This report, after all, is a representation, as are books, train timetables, reports, paintings, maps and so on. All these things are used to refer to something other than themselves. Nearly anything, in some context, can be read as referring to something else. For example, a coat on a coathanger meaning someone is home, or a dropped handkerchief as a sign of infidelity. Robinson (Robinson and Bannon, 1991; Robinson, 1993a; Robinson, 1993b; Robinson, 1994) has discussed at some length how everyday artefacts are used as representations. Robinson calls these “common
artefacts", everyday objects that take on a role in collaborative work or interaction. One of the best examples he discusses is that of the hotel keyrack:

The keyrack behind the reception desk in a hotel is an example. Guests can leave and collect their keys; can see which other guests are in or out, and leave messages in the pigeonholes. Hotel staff use it to communicate with their colleagues, and place bills, faxes etc. to be given out to guests. The presence of keys, or the contents of pigeon holes, conveys information, and may be the subject of questions or discussion. Some operations are considered legitimate, while others are not: usually only the receptionist can place keys or messages; keys have to be hung over appropriate numbers; etc. The keyrack is a model of the hotel, mapping the rooms. A glance at it in the late evening gives an overview of the hotel occupancy. (p190-191, Robinson, 1993b)

The keyrack fulfils both a practical and a symbolic use. As well as being a physical receptacle for bills, faxes etc., the status of the keys on the racks can be seen as signifying the status of hotel occupancy. The hotel keyrack is a representation - it is modified in some way to indicate the supposed changes in some other phenomenon.

On a straightforward level then, a representation is something that is used to indicate the status of something else. It can be "read", or "updated" to tell the user about something else in the world. In this rather wide definition what is a representation is what is used as a representation. The keyrack is only a representation in so much as it is used that way. Otherwise it is just hooks and wood.

Unfortunately, very few empirical studies have been done into how representations such as Robinson's keyrack are used in practice. Representation has remained, for the most part, a philosophical concept or, within 'mainstream' sociology, is discussed in abstract and general terms. The field which has most closely concerned itself with representation, semiotics, has concerned itself with the "hidden" meanings behind media, the systems of signification which lie behind and support the meanings of texts. This has led to philosophical discussions of the status of representations or analysis of representation in "texts" such as television programs or philosophical textbooks. Semiotics has avoided discussing what might be considered the literal "what everyone knows" meaning of objects in use. The focus is on the myth rather than the language (to use Barthes' term) (p115, Barthes, 1972). In this way "It loses sight of the way language is orientated to activities: it obscures its practical nature" (p72, Potter, 1996). Another criticism of semiotics is that the audience is only referred to through the analyst, we never actually hear from actual audiences, of what

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33Semiotics starts with de Saussure and passes through (Barthes, 1972) and on into post-structuralism (Eco, 1984). (Potter, 1996, chapter three) is a succinct discussion of this, and also the criticisms thereof.
they might think. The audience is only referred to as an object of academic speculation. This not only privileges the analyst, but privileges a sociological account over an everyday account of meaning. As Potter puts it again:

Part of the problem with using [semiotics] as a basis for a general theory of fact construction arises from the tendency to assume that interpretations of formal literary texts are the key to understanding the world. Against this it could be argued that stories and descriptions in more mundane, everyday settings are at least as fundamental" (p76, Potter, 1996)

As Joerges puts it, semiotics shies away from the everyday, towards "lofty sign acrobatics" (p224, Joerges, 1990). This ignores something of great interest. By looking at actual examples of representations being used, it is possible to see the activity around representations that makes them representations. That is, representation as an achievement, rather than something which is taken for granted.

5.3 Computer databases as representations

As was discussed in chapter two, Notes has some similarities with database systems, but it is not usually described as a database system (although, rather confusingly, a Notes system is made up of individual Notes databases). Database systems are quite different to more familiar computer applications such as spreadsheets and word processors, designated primarily by their sheer size. In Britain, for example, the government's national insurance computer has over 20 million records, and some commercial systems are even larger. The design of Notes, however, does not follow the traditions of standard database design. Notes databases are very small in comparison to mainstream databases, often just holding a few hundred records. In addition, Notes is neither "object-oriented" or "relational" - the two main database types (Date, 1995). Notes is structured in more of an ad hoc manner, and thus something of an anomaly in the heavily structured world of database design. While Notes borrows some of the terminology of database work - types, views, databases, fields etc., it uses them in subtly different ways. For example, the type of a 'field' can change on the fly in Notes, something that would be very unusual in standard database design.

However, what both Notes and standard databases share is that they are both representations. They are purported to be a signal of some other phenomena, be it cans of soup on shelves, or hours spent at work. Although the notion of representation is part of the description of databases given in database textbooks, it is treated as a simple unproblematic notion, left behind as the discussion moves onto more technical details (Beynon-Davies, 1992). Discussion of the philosophical status of databases has remained at the fringes of the database community. It seems, perhaps
with good reason, that these philosophical questions are too esoteric for those concerned with the actual design of databases. This is not to say that this notion is unproblematic. As an investigation of how databases - like Notes - work, we can start by asking questions about how a database represents. To say, as is often done in the field of database design, that "database X represents Y" assumes something which can be investigated. How does a database come to represent something, and in what form does it represent it? Answering these questions gives clues to understanding how it is that a database is used.

5.4 Theories of representation

The major challenges posed by the growth of open and integrated systems prompts a careful rethinking of the basis of modelling (Hanseth and Monterio, 1994)

Some authors have turned directly to philosophy to understand how databases represent the world. Hanseth and Monteiro's paper (Hanseth and Monterio, 1994) addresses the "basis of modelling" with regard to databases:

The heart of our analysis, then, is to compare [data] modelling with a body of theories from the philosophy of language as theories of reference (ToRs) ... theories of reference have been developed within the philosophy of language to explain how linguistic entities (words, sentences, propositions) accomplish the truly extraordinary task of referring, i.e. to point to the essentially non-linguistic entities of our surrounding world. (ibid.)

Theories of reference (ToRs) explain how it is that the process of referring works. While these were developed to apply to language, Hanseth and Monteiro show they are just as applicable to computer databases. They describe the "two level" ToR, commonly known as the "correspondence theory of reference - the idea that words, sentences, pictures and signs 'correspond' to independent objects in the world" (p140, Lynch, 1994). So, for example, the expression "John" is associated with the person John thorough a link. This relationship is what is known and exploited by individuals when they talk about John.

Although straightforward, this "two level" ToR has many shortcomings. Most importantly, we have to ask how it is that a word like "table" is connected with all the different sorts of things that we come to call a "table". As Wittgenstein puts it:

But is there only one way of taking the word ‘colour’ or ‘length’? - Well, they just need defining. Defining, then, by means of other words! And what about the last definition in this chain? (Do not say: ‘There isn’t a last definition’, That is just as if you chose to say: ‘There isn’t a last house in
this road; one can always build an additional one'.) (Wittgenstein, 1953, §29)

If we have labels, what is written on the labels? And how do we understand the labels? With more labels?

A second problem is that not all language takes the form of referencing stable objects. Imagine being showing unsturdy wooden tables and on seeing a solid mahogany one exclaiming "Now that's a table!" Here the use of the word "table" is not just simply naming an object but emphasising its characteristics. It is not that language never refers to the world, but to see it as only referring to objects in the world is to ignore the ways in which it is used.

Applying this to how databases represent, we can see that a "two level" ToR for databases will have similar problems. With a complex record like a "sales transaction" held in a database, one cannot just point to what the record signifies. There is no simple and straightforward one-to-one connection between "the database" and what the database is representing. How do we know what a "price" stored in a database is? How do we connect it with something "in the world"? Kent (Kent, 1978) picks apart the idea of a one-to-one mapping between reality and what is in a database by going through each concept of database design - relationships, entities, and so on, and shows how there is no simple mapping between them and reality. Moreover, databases, like languages, are often used in non-representational ways. An excellent example of this is the vendor information database described in chapter three, where a database was used as a 'conversational device' to cut short sales telephone calls. The important thing about this database was not that it represented reality, but rather how it came to be used in interaction with sales calls. This a "two level ToR" cannot help us to explain.

5.4.1 Wittgenstein's Database

These are just two of the problems with a simple two level ToR although there are many others. The question to be answered is how is it that a reference gets 'attached' to what it is meant to refer to. What is the relationship between the referent and the representation? One solution to these problems, and one that is particularly interesting for an empirical study such as this, is Wittgenstein's. Wittgenstein is a

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34Lynch (Lynch, 1994) gives a more in-depth discussion of this point, using an example from Wittgenstein (his 'builders' discussion) to show that even a simple language of only a few words can be used to make statements where the meaning is a joke, to emphasise a change in terminology, to doubt what someone is saying, and so on.
difficult writer to understand - Hanseth and Monterio avoid him in their paper\textsuperscript{35}, although there is no shortage of secondary material on his work\textsuperscript{36}. Wittgenstein's solution to the "problem of representation" is interesting in that it directs us to looking at actual cases of representation to understand how it works. His arguments has also influenced much ethnomethodological thought and provide a way in which representation can be studied empirically as an \textit{activity}\textsuperscript{37}.

Wittgenstein argues that the representational properties of language are something which are settled in everyday use. In day to day conversation we seldom have problems with understanding what people are referring to. Wittgenstein suggests that the link between the referent and the reference is thus an imaginary problem - indeed to separate them is to make a mistake. It is in our conduct, in what we do, that we come to understand what references mean and how they are used.

When we hear a word used, and we know what it means, we act as if we understand that word. For example, someone shouts "stop" as us, and we stop. Wittgenstein argues that the \textit{meaning} of a word is that very behaviour when the word is used. This is what he meant when he famously wrote that "the meaning of a word is its use in language" (Wittgenstein, 1953, §43). Meaning is the word we use when we act as if we understand. It is the patterns of behaviour around the correct use of words which we call "understanding". When we \textit{misunderstand} that is when we behave the wrong way around the use of a word.

\textit{Using language}, then, is the process of acting as if we understand. The connection between the referent and the reference in language is therefore an emergent property of using language correctly. When we understand what a word refers to, we act as if we understand. This means we can say we understood what it referred to. To the reader unaccustomed to this argument, this might seem a rather esoteric point. Wittgenstein, however, masterfully argues it out, showing that any other way in which meaning is established is insufficient. But while the arguments behind this point are

\textsuperscript{35}They claim that "language games are usually regarded to have little or nothing to do with ToRs". This is an mistaken claim, disputed by most of the secondary work on Wittgenstein, such as (Fogelin, 1976, p144-165).

\textsuperscript{36}Good general introductions include (Fogelin, 1976; Kripke, 1982; Bloor, 1983). There are, however, problems in these books, as they tend to take a sceptical interpretation of his discussion of following a rule (Lynch, 1992; Hacker, 1995). Hacker's monumental four volume treatment is the definite guide (Baker and Hacker, 1980; Baker and Hacker, 1985; Hacker, 1990; Hacker, 1996b). Some writers make a divide between the "late" and the "early" Wittgenstein (although it is perhaps better to see his writings as a progression (Hacker, 1996a)). Under that categorisation the discussion here is concerned with the "late" Wittgenstein.

\textsuperscript{37}Wittgenstein himself had no interest in empirical study. In a sense Garfinkel can be said to have developed his ideas in an empirical direction, although this is downplayed by many ethnomethodologists (footnote 65, Lynch, 1993).
complex, one implication is not. If we want to understand how a database 'means' something, how it is connected to the world, we need do no more than go and look at how it is used. Lynch makes this point when he says:

Instead of asking, "what do we mean, in various contexts, by 'representation?'"; the studies [here] begin by asking "What do the participants, in this case, treat as representation?" (p11, Lynch and Woolgar, 1990)

And also:

Wittgenstein and ethnomethodology inform us that the extent to which expressions and texts take on referential functions may owe less to the intrinsic properties of representational items than to the deeds performed when those items are embedded in action (Lynch, 1994)

To see how representation works and solve our original problem of understanding how it is that databases "represent" the world, we need to go and look at the actions around databases, the work which is done with databases in both putting information in, and using that information.

The meaning of the "price" in a computer database is not something solely decided by the fact that it is a "price". Instead, its meaning comes from the way it is used. We might, for example, know that a certain supplier always adds extras to the final price, or that they can be bartered down. The meaning of some information in a database is not a simple thing which can be read off - we have to look at its use. In this, computer databases, as representations, are similar to language. Meaning is established in the different "language games" which are played as the database is used. Different databases will have different language games and the information in different databases will be used in different ways. It is in the behaviour of staff with a database that it achieves meaning. This "establishing meaning" can be seen as a practical activity and something that can be studied38.

Demonstrations of the meaning of databases coming from their use can be seen in (Gasser, 1986) and (Bowers, Button et al., 1995). These papers describe workers "knowingly using 'false' data to obtain desired analytical results by tricking their system" (p216, Gasser, 1986). (Bowers, Button et al., 1995), for example, describes the staff of a printing company entering false records into a workflow system so as to be able to get their print jobs done on time. These fake records make sense to staff in the context in which they are input. So long as one is aware of the workarounds, the

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38Of course, what meanings can be established are limited by the social context. We can't just decide on some ridiculous interpretation of what the entries in a database mean in toto.
records make sense. The 'meaning' of the records comes from how they are used. Zuboff also shows this in her discussion of how staff in a papermill struggled with understanding the data presented to them on a newly installed computer system (p79-92, Zuboff, 1988) . The meaning of the information held in the computer only came as a result of the staff acting with it. Meaning came from the use of the data.

Wittgenstein "opens up" the notion of representation, showing that it is located squarely in what we do. Databases, and how they are used to represent the world, can be understood by looking at their use in action.

5.5 Social constructivism and making facts

Research in the sociology of scientific knowledge (SSK) has touched on these issues by asking how it is that "representation" is done in science. That is, what work is done by scientists to get particular theories seen as accurately "representing" the world. This research can help us in asking how it is that computer databases too are seen as "representing" the world.

SSK39 originated during the mid 1970s from dissatisfaction with the standard sociological model of scientific discovery (Mulkay, 1979). Before SSK, sociological studies of science had failed to challenge the standard view of science as a 'process of discovery', facts about the world being discovered by scientists working together in labs. This is the account of science that one receives from television programmes, articles in newspapers and the books and speeches of famous scientists. These are built on the assumption that the world exists and scientists discover facts about the world. Writers in the sociology of scientific knowledge challenged this by studying scientific facts "as they are made" - the social processes which go into the formation of scientific knowledge. How is it, SSK asked, that one fact becomes accepted in science over another (Collins, 1983)? Researchers combined ethnographic studies of laboratories with the development of theoretical approaches (such as social constructivism and ethnomethodology) which had been marginal in mainstream sociology.

Science can be seen as based upon the production and validation of representations of the world, representations which are accorded the status of 'truth'. This has led SSK researchers to investigate the production of these representations and to ask questions regarding their status. For our purposes here, two writers who developed their work

39(Collins and Pinch, 1993) is an accessible and enjoyable introduction to SSK. Foundational works include (Latour and Woolgar, 1979; Gilbert and Mulkay, 1982; Collins, 1985; Lynch, 1985)
in SSK are of interest, Steve Woolgar for his discussion of representation, and Bruno Latour's for his discussion of immutable mobiles.

Woolgar can be broadly described as a social constructivist. Modern social constructivism can be traced back to Berger and Luckman who in turn credit Alfred Schutz (Schutz, 1962; p29, Berger and Luckmann, 1966). Social constructivism views taken for granted objects, such as scientific facts, as 'social constructions'. Objects as diverse as optical pulsars or the continent of America are constructions, and the work of their construction can be examined. For example, everyone knows that America was "discovered" by Christopher Columbus. This discovery, however, was not an instantaneous event. Rather, it was a process whereby Columbus sought publication and communication of the news of his discovery, culminating in the Vatican's approval of Spanish claims to the discovered lands. Moreover, Columbus originally viewed his explorations as discoveries of islands off the east coast of the Indies, and it was not until the explorer Verspucci’s later claim of an extended land mass that we get to the current view.

The historians of the sixteenth century rewrote Columbus's achievement as one of discovering America - contrary to his own specific claims. This view that Columbus "discovered America", is not one that even he himself held. Columbus' discovery of America can thus be seen as a 'social construction', rather than some unproblematic event. Individuals worked to socially 'construct' the 'fact' of Columbus discovering America. From a social constructivist viewpoint like Woolgar's, it is by our naming, talking and forming knowledge about objects that they achieve their solidity and permanence.

This can be applied to scientific 'facts', as much as to historical 'facts'. In one book, Woolgar describes the discovery of an optical pulsar (Woolgar, 1988b). He characterises this as a process of 'constructing' the pulsar. To do this, he suggests, scientists found a representation, then from that representation hypothesised an object - the optical pulsar. They then made that representation plausibly appear to represent the object, and finally ignored all this construction work:

\[
\text{Representation} \\
\text{Representation} \rightarrow \text{object}
\]

40This examples is from (p58, Woolgar, 1988b) where he credits (Brannigan, 1981) with the original idea.

41One problem with social constructivism is that it leads to the overuse of 'scare quotes' as Woolgar calls them (Woolgar, 1983). This is because of the attempt to dissolve notions like 'the social' or 'facts' and see how they are constructed. To the uninitiated it can seem rather obtuse.
Discovering a pulsar is, then, the process of getting a representation to appear to believably represent a pulsar. It is the job of constructing an arrow connecting 'the representation' and 'the world'. While Woolgar's brand of social constructivism is perhaps the most extreme (Sismondo, 1993), constructivism has become an increasingly popular position, with social constructivist studies now being conducted in a number of fields (p87, Shadish, Fuller et al., 1994). What these studies demonstrate is that a wide range of objects, such as scientific facts, that had previously been taken for granted can have their production sociologically investigated. The taken for granted can be "exploded" to reveal how it is produced.

What is interesting here is the notion that representations are actively "made" to be representations. That is, work is done to establish a particular representation as "a representation of x". This can be seen in (Amann and Cetina, 1990), where scientists are shown talking around photographs so as to "work them up" - to see what they actually consist of:

[Data is subject to] rendering practices which attempt to achieve the work of seeing what the data consist of. ... The image, here, becomes a "workplace" (Lynch, 1985) for participants in seeking an answer to this question. The sociology interesting phenomena is that seeing is work. (p90, original emphasis)

The point here is that the photograph is not 'obviously' what it becomes. There are potential faults, mistakes, smudges and so on, which must be discarded. For a photograph to be seen as, say, evidence of a type of chemical reaction in the brain, we need to talk around the photo. There is no straightforward way to get to what is being photographed/represented and thus we resort to other methods for rendering the photograph a photograph of "x". The fact that the photograph is treated as a

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Woolgar's position has come under considerable criticism. Arguments over social constructivism and social approaches to science generally have increasingly become part of an academic fracas (Editorial, 1997). Specifically with regard to Woolgar (Sismondo, 1993; Wolpert, 1993) are interesting critiques. Ethnomethodologists have also attacked Woolgar's presentation, comparing it with Garfinkel's discussion of the same events (Garfinkel, Lynch et al., 1981; Button and Sharrock, 1993).
representation is something which comes out of the work of the scientists talking around the photos rather than just the photograph itself.

5.5.1 Achieving Woolgar's arrow: Databases as a practical accomplishment

Woolgar's constructivist discussion can also be applied to computer databases. Just like scientific representations, they are 'made' to be representations by the actions around them. A database is not taken as a representation unproblematically, but must be made to look like it represents and this representation must be maintained. There are some differences between science and databases. The work is not one of proving the existence of the phenomena, but one of constructing and maintaining a "workable" relationship between the represented and the representation. It is the production and maintenance of "Woolgar's arrow" (the document -> object connection in the figure above). Without this being successfully pulled off, the database is nothing more than a 'fiction'.

It is establishment of the database as a reasonable account of what is being represented. The fact that "the database is a valid representation of X" must be a reasonable and thus believable proposition. With it, the database is a successful account, representing reality and a useful tool for inspecting 'reality'. In some of the databases described in chapter three (section 3.4.3) there was a "breaking" of the arrow, resulting in the databases falling out of use. A database that is not believed to be a "reasonable account" is not going to be trusted. These were failed attempts to establish Woolgar's arrow.

How is Woolgar's arrow achieved? How is a database made to be believable? This work is not just making the representation 'accurate', since often databases have no simple 'referent' against which they can be checked. This makes their accuracy something which must be achieved and displayed using other means. Using discussions of how scientific theories are established, we can see the different ways in which Woolgar's arrow is achieved with databases. Five different ways of achieving Woolgar's arrow can be identified:

1. Tallying with other representations

Representations must tally with other representations of the same or overlapping phenomena. If they do not, then one of the representations must be incorrect, something which undermines a representations' claim to accuracy. In simple cases, these other representations could be verbal accounts or first hand observations. A stock control system must appear to tally with what is on the shelves, at least most of the time, for it to be believable. In more complex cases, chains of representations exist with subsequent representations depending upon previous representations.
database of unemployment rates per country in turn depends upon other representations of unemployment. These webs can be checked to confirm and ratify information held in different representations. As Bowers put it when discussing government statistics:

What is more, the formalism in use will not stand alone - it will be very 'well supported' and the links it makes with the world are rhetorically strengthened. Like the strands in a rope, there are a multiplicity of well-ordered and combined elements connecting one end (the object) with the other (the formalism). The advocate can now say to any opponent: 'You doubt my formalism? Ok, here are all the representations which stand before it. Make sense of those some other way if you will.' The price of disputing a 'well-supported' formalism is to take the sceptic back to the mass of representations before it. Dealing with these afresh may be more than the sceptic can bare. (Bowers, 1992)

This is similar to the way scientific theories are formed in a "web of beliefs" (a notion credited to Kuhn (Kuhn, 1970)). A theory which meshes with other established theories is more likely to be accepted than a revolutionary one.

2. Reasonable account

A representation must also be reasonable in that what is says must seem a reasonable account. If a database claims, for instance, that no one is in the office for the following three weeks, in a busy office this would seem unreasonable. In Harper's ethnography of a finance department (Harper, 1988) he writes about how costs coming from branch offices would be judged by a process of "looking for the right numbers". Staff had various expectations for the costs coming from branch offices and looking for anomalies was an important device to find errors. Even if errors were not found, contacting the branch offices to discover the cause of the "unusual" numbers would help to inform head office of the underlying circumstances.

In science the idea of reasonableness can be seen in Occam's famous razor - that scientific theories should be as simple as possible. A more complex theory is rejected as not being as "reasonable" as a simple one.

3. Visible updating

A representation must be seen to be updated. When a phenomenon is likely to change, the representation must also be seen to change, otherwise it will lose credibility. Representations gradually lose credibility: annual statistics, for example, appear increasingly 'inaccurate' as the year progresses. Making the updating publicly
visible can help to establish the credibility of a representation by helping to show that a database is 'up-to-date' and thus accurate.

4. **The view from nowhere**

Credibility is also crucially linked to how the representation is presented. One important device is to present representations as *authorless*. They typify the "view from nowhere" (Nagel, 1986), in that any sense of authorship included within them is deleted. This makes the information included in them appear objective and accurate, detached from the situation of their production (Porter, 1993). This is at the heart of objectivity, since objectivity is to not be not attached to any particular individual’s viewpoint. Computer databases are particularly powerful in this regard, since an automated computer record deletes the author to the extent that it is the computer that appears to be the author. Records are calculated and updated *by the computer*, and appear authorless.

Again there is a parallel with scientific theory. As Woolgar and Latour narrate in their description of "the making of a scientific fact", the contingencies of a theory's production are stripped away as it makes its way from theory to fact (Latour and Woolgar, 1979). Both scientific facts and databases have their authorship deleted so as they can appear "objective" and not the view from any one person.

5. **Appeal to procedure**

If the workings of a representation can be explained, then reliability can be asserted by referring to the workings. If the representation is known to be updated in a regular, reliable manner then it follows that the contents of the representation 'must' be reliable too. This is the appeal of standardised procedures - they give the appearance that the representation is a regular, reliable entity. If these workings are computerised, all the better, since then they are 'automatic' and not open to the criticism of human error. Controls also play a role here, since they can enforce the 'regularity' of how the representation is updated. By highlighting *the controls*, the regularity of the updating can be established, and this in turn passed on to the reliability of the representation.

This last 'device' also has a parallel in science. The methods section of scientific papers is an attempt to establish the accuracy of the results by making the claim that the mechanisms behind the evidence presented in the paper are valid. The workings justify the evidence (This is a point we will return to in section 6.4).

*Accomplishments*

The aim of listing these devices is to show how representations are accomplishments, in that their representativeness is the result of work done to make them appear 'true'.

Page 130
Without this accomplishment, representations become discredited. The credibility of a given representation is an ongoing process for those involved with the representation. Since there is no simple route to what is being represented, other devices must be used to establish representativeness. A computerised finance system, for example, will often be the only way of getting to the details of financial transactions. The only way to checking the finance system will be by resorting to other representations, for instance, how much money there is in the bank. Maintaining a representation involves the precarious job of maintaining a spider's web of connections with other representations. In addition, the database must appear 'reasonable', otherwise it will not be believed. The machinery of its production can be used for this in that it 'demonstrates' the database's accuracy. These devices allow "Woolgar's arrow" - the connection between the representation and the represented - to be achieved.

5.6 Latour's "immutable mobiles" and the work of formalisation

After discussing representation, this chapter now moves on to discussing formalisation. Latour has developed (along with Callon and Law) the so called "actor network theory" (ANT) to analyse social situations using a network metaphor. One concept from Latour's work, that of the "immutable mobile", is helpful in understanding why representations are so useful to organisations. Latour uses the details of the mundane and small scale as building blocks in his grand narratives. In (Latour, 1987) he looks for what separates the modern world from those which went before it. He comes to focus on "writing and imaging craftsmanship", on the files and paperwork ignored in conventional sociological accounts of organisations. Latour argues that it is that the long distribution networks through which records, papers and reports travel which are fundamental to many other modern activities. Indeed, when we can discuss entities such as the "state", the "corporation" or the "economy", we ignore the fact that these entities could not exist at all without the circulation of records. Latour describes the objects which are used to transmit information as "immutable mobiles" - a material translation of any setting that travels between the context of action and the actor remote from that context. Reports, letters, statistics: these are immutable mobiles as they move details of one setting to another and allow observation at a distance. They are immutable in that they can be moved to another context (without decaying) and be understood in that context. Describing the "bureau" (office) part of bureaucracy, he writes: bureaucracy

The "bureau" is something that can be empirically studied, and which explains, [...] why some power is given to an average mind just by looking at files: domains which are far apart become literally inches apart; domains which are convoluted and hidden, become flat; thousands of occurrences
can be looked at synoptically. More importantly, once files start being gathered everywhere to insure some two-way circulation of immutable mobiles, they can be arrayed in cascade: files of files can be generated and this process can be continued until a few men consider millions as if they were in the palms of their hands. (p28, Latour, 1986a)

Robson (Robson, 1992) applies this idea in his discussion of accountancy. To Robson, the early developments in accounting were attempts to create mobile inscriptions. Some of the first examples of writing were lists of possessions recorded in ancient Mesopotamia. These lists enabled trade over distances since they could serve as basic invoices. Without this record of quantity and quality it would have been much harder for trade to take place over great distances and barriers of language. Robson argues that the history of accounting has been the increasing development of these inscriptions, since they allow us to aggregate, tabulate and compare inscriptions to establish new relationships between distant objects.

5.7 Formalisation as a social project

Perhaps the most important aspect of inscriptions is how they can be used to formalise phenomena. Quantisation in accountancy formalises:

We cannot add apples and oranges 'meaningfully'. But this ignores the power of numbers qua numbers. We can add apples and oranges and call the result fruit ... Numbers seemingly break loose from the ordinary-counting subject and enable re-assembly, transformation and aggregation to 'reveal' new relations among their symbols, and form new categories that invite definition (p698, ibid.)

What this demonstrates is the power of formalisation, the encoding of details of the world into standardised notation. Numbers are just one example of this. Others are geographic maps (Wood, 1992), graphs, questionnaires, and of course, computer records. These devices allow the complex, imprecise details of the world to be reduced to a controlled, constrained, form. Formalisations are ordering devices, synthesising detail into one form or another.

Formalisation is the key to understanding immutable mobiles. The important thing about immutable mobiles is that they allow, through formalisation, the reduction of detail:

So the phenomena we are tackling is not inscription per se, but the cascade of ever simplified inscriptions that allow harder facts to be produced at greater cost. (Latour, 1987)

This is what quantisation as a formalisation enables - the reduction of the details of the world. Quantisation, however, does not just represent, but allows manipulation
and re-representation. With abacuses, numbers can be manipulated by moving beads, without reference to whatever is actually being counted (Hutchins, 1995). Formalisations enable work at a distance, since the manipulation of formalisations in one place is taken to tell us something about phenomena at another.

A more specific definition of formalisation is as a process of encoding information into a form where it is constrained by a grammar. The constraint is important here, the restrictions on how the information may be encoded, since this gives formalisations their structure. Limitations can take the form of restrictions on the number of symbols, the order of those symbols, or restrictions on what can be done with those symbols. As Bowers puts it, “to formalise, then, is [...] to distinguish between the legal and the illegal.” (Bowers, 1992). These restrictions help to reduce the detail to what is considered relevant. By restricting the description of a row of cars to their quantity we discard details such as their colour. The restriction removes excess detail.

Formalisation will be familiar to anyone who has ever designed, or even used, a computer database. Computer databases formalise the world in a very specific, predefined form. Devices of dividing, attributing, re-representing and so on are essential to be able to produce formalised accounts of a less than ordered world, to turn the rude chaos of the world into a database.

These "practices of formalisation" work hand in hand with representation. To be able to represent one must reduce all the details of what is being represented in some way. As Bowker puts it:

These diverse authors have all turned their attention away from dazzling end-products in various forms of Hammurabi’s code, mythologies, the theory of evolution, the welfare state, and so on. They have instead looked at the work involved in making these productions possible. They have dusted off the archives and discover piles and piles of lowly, dull, mechanical lists (Bowker and Star, 1993)

Perhaps the most famous discussion of formalisation has been Foucault’s dissection of disciplinary practices and his suggestion that these are the foundational structures of both the sciences and the modern era (Foucault, 1979; Bowker, 1993). Foucault’s disciplinary practices include dividing, ordering, list making, quantisation. Foucault, like Latour, suggests that it is these small building blocks which make the modern world possible.

5.7.1 The development of formalisation as a form of information
In chapter two, Yates's investigations of communication at work was discussed. Yates (Yates, 1989) showed how much of the development of the so called "rational bureaucracy" was connected with the standardisation of written information flows. This was formalisation in two ways. The paths through which communication flowed were regularised and fixed. Daily reports, for example, allowed managers to track the actions of their organisation, even though they were distant from the actual sites of work done. The second formalisation was of the communications themselves. Yates tracks how the business report developed from the letter style, to standardised reports with graphs and tables containing the necessary information. This two fold formalisation, of information path and information form, was also applied to other types of organisational communication. The circular letter, the general order, the organisational manual, the order form, the in-house magazine, the tabular report and the office memo - all these became increasingly constrained in their format and distribution.

Yates demonstrates this with the order form. These were developed for the day-to-day communication of orders and instructions to specific employees. Experts recommend that orders should be given in written form because this overcame:

> the problems inherent in depending on an individuals memory as well as the potential for friction or conflict over the specific terms of an instruction (p73)

The use of pre-printed forms could also be used to structure what was being communicated. For the user of the form, this guaranteed consistency and accessibility of content. To find a certain piece of information the user could simply look at the same place on the form each time. Forms could also be easily compared with each other and the information could in turn be recombined on a new form at the next organisational level. This formalisation even went as far as attempts to remove qualitative information from forms altogether. Yates gives an example of a form where the "remarks" column was formalised into check marks under different categories. "This not only decreased the clerical work, but made the totalling of the separate excuses comparatively simple" (p84).

5.7.2 Databases and Formalisation

Thus it has been argued that all the business advantages of being able to process huge amounts of data should not be traced back in time to the computer (which its advocates have claimed to be the source of this new ability) but to changes in bureaucratic organisation which in turn made the computer possible (p235, Bowker, 1993)
Formalisation was carried one stage further with the development of the computer database, the immutable mobile par excellence. Databases are mobile - accessible anywhere on the computer network and a clear example of formalisation at work. The heart of database design is formalisation, turning unmanageable chaos into ordered and structured records. They take rough, unsorted, details of the world and reproduce it in an ordered, formalised and tidy manner. All the elements in a database are arranged logically and comprehensibly, subject to rules restricting what can be recorded. It is these rules which are the building blocks of computer databases. The world is represented in this manner through the application of devices of database formalisation:

1. **Divide and conquer**

   Formalisation of the world requires its decomposition into different entities. The common sense way of looking at the world already does this: we see objects such as tables and chair, rather than just “the world”. This decomposition, however, is not an \textit{a priori} one. Sometimes we might talk about “the university”, or “the department”, the entities we choose to divide phenomena into are dependent on what we are looking to do. Databases make use of the technique of dividing phenomena into different entities. In database design this is known as \textit{decomposition}. Division creates ‘similar’ entities, or at least, a notion of similarity is constructed by the very division into separate elements. In this way, people (for example) can be classified as similar ‘entities’, even thought those people might not have anything in common (or the people might not even exist). In turn, the entities being decomposed might be further decomposed again - a \textit{hierarchical} decomposition, a form of ‘divide and conquer’\footnote{This has similarities with Foucault’s notion of partitioning (p143, Foucault, 1979)}.

2. **Attributes**

   The decomposition into discrete entities is followed by the assignment of \textit{attributes} to those entities. Attributes are properties or descriptions of features of that entity. Common attributes are often standardised, so that, for instance, every person in a database has a first, middle and last name, a gender, a passport number and so on.

   Attributes combined with decomposition are powerful devices since they allow the creation of \textit{the same in the different}. What previously was diverse and numerous heterogeneity is now discrete and similar. Although two individuals might think very differently about their weight, by applying similar attributes they become \textit{similar} in so
much as they both have a numerical weight. Allocating attributes of similar qualities (weight, age, sex etc.) makes each entity measured and distinct, yet similar with each other. Each entity has a weight, a sex, an age - they are made to appear the same.

3. **Coding, classifying and clustering**

The entities and descriptions can now be classified into groups. Clustering, or classification, reduces the need to concern ourselves with numerous and overwhelming difference. People can become "men" and "women", with no concern for any deviants outwith those categories. Clustering, as well as reducing numbers, effectively recreates the entities in terms of the coded categories. Not only is variation removed, but entities can be referred to by their clustered attribute. An entity can be stereotyped by whatever term has been used to cluster it.

4. **Ordering**

Once the represented phenomena has been divided into entities and we have drawn descriptive attributes from these entities, it is possible to order them in terms of their attributes. Ranking then allows comparison between each entity and the others. Ordering allows each entity to be considered individually, but only with reference to the whole. The consideration is of the individual, so is specific, but is also relative to every other entity. A ranking is an comparison of each element with every other element.

5. **Standardisation:**

The above devices help make local phenomena - situations, places, views, people, positions and so on - portable. Unemployment, for example, is an experience of individuals who are not in employment. Communicating the level of employment in a country would be impossible if one could not produce a portable representation of that unemployment - a statistic - which can then be taken far away from the site of its production. However, to be able to construct portable representations of local phenomena one more device is necessary. For representations to be defensible (for Woolgar's arrow to be secure), the procedure of their production must be standardised.

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44 Gender is a good example of classification, since it is at first assumed that everyone is either male or female. Gender, however, is just another constructed category. See the discussion of Agnes in (Chapter five, Garfinkel, 1967) or the classification of transsexuals (Ormrod, 1971).

45 Again, here there is a similarity with Foucault's notion of rank (p145, Foucault, 1979)
It is the reliability of the representation - its ability to produce 'similar' results with 'similar' inputs - which is the achievement of standardisation. A household might be described as a certain standardised entity, so as to be able to segment a street into different households. Attributes in turn might be described in standardised ways. This standardisation makes the connection between the represented and the representation more supportable. Appeals can be made to how the representation is collected. If it is possible to show the regular, reliable way the representation is constructed, then the representation is more sustainable.

Porter's (Porter, 1993) discussion of the changes in how wheat was sold in Boston between 1840-1860 illustrates this clearly. The first step in standardisation came from the efforts of the Boston board of trade to enforce the use of a 60-pound bushel of wheat, over the old bushel stack, which was unsuitable for the new grain elevators being introduced. While this standardised weight of wheat was moderately successful, it produced another problem for the Boston board of trade. Since it was the elevator operators who selected what was suitable wheat to be transported, farmers began to mix their wheat with dirt and chaff, since they could receive the same price for it. Soon, the price of wheat from Boston fell to 5 to 8 cents below that of Milwaukee. To prevent this, the Boston board of trade began subdividing its wheat into grades based on quality, eventually training inspectors to certify the grade of each shipment of grain traded on the wheat exchange. To this was added laws against mixing wheat of different grades. Bureaucrats managed to create what had never existed in nature: uniform categories of natural produce.

6. Inscription

Formalisations only have life in as much as they are embodied in some way. Formalisations live their life as inscriptions. They live in many different places, from the abacus to the keyrack, but they especially live on the paper page and in the computer. Latour tells the story of the explorer La Perouse, on his search for a better map, and describes his meeting with the Chinese:

'An older man stands up and draws a map of his island on the sand with the scale and the details needed by La Perouse. Another, who is younger, sees that the rising tide will soon erase the map and picks up one of La Perouse's notebooks to draw the map again with a pencil... (p5, Latour, 1986a)'

While La Perouse's expedition never made it back to France, the maps did, and subsequently assisted the determination of commercial routes for French shipping in the Pacific. It is the ability of the embodied representations to be moved to different settings that allows one to move information. Added to the ability to standardisation
the representation can now move to a new context and be understood in this new context. It is *mobile*.

7. **Re-representing, synthesis, collation, summary and extraction**

With our formalisations mobile, different formalisms can be gathered in one place. Representations which relate to dispersed entities can be combined or recalculated in a variety of ways. It is the ability to re-represent and reduce which makes mobile formalisms so powerful. Figures on growth in a database can be re-represented as the success or failure of a country. Combine them with other figures and you can argue for or against government economic policies. Data can be *pivoted*, for example, changed from unemployment by inflation, to inflation by unemployment. The Philips curve can be conjured or dissolved by how one fashions the numbers. Representations are *malleable*, in that they can be recollated, summarised, or extracted into different forms. “Formalization enables the intertwining of multiple rerepresentation paths. With formalization and computation, the health of the nation and the state of the public economy become addressable in the same breath.” (Bowers, 1992)

8. **Quantisation**

Perhaps the biggest achievement of formalisation, and certainly the way in which formalisation is most apparent, is *quantisation* - the ability to reduce almost any phenomena or activity to numbers. Once entities are ranked in order, numbers can be allocated to them, reducing them to single numerical figures. With a standardised method of collection (or at least, appeals to a standardised method) and portability on the printed page, numbers aspire to the status of truth. Robson's work described earlier (Robson, 1992) discusses why quantisation has been so powerful; it enabled the *portability* of representations. Counting is something that can be standardised, and this combined with the international mobility of the written number (in a historical European context) enables numbers to be used at large distances away from the site of their creation. From numbers come statistical analysis, and the ability to calculate norms, deviancy and other statistical measures. Hacking describes 1820-50 as the era of the “avalanche of printed numbers” with a related rise in social and political concern with human “normalcy” (Hacking, 1981). With statistics whole countries can be reduced to numbers in tables. In a related review essay Porter (Porter, 1992) argues that a similar process required companies to produce objective financial information so as to increase public confidence and generate investment. As Hammer put it, echoing Bishop Barclay, “if you cannot measure it you cannot *control* it.” (Hammer and Champy, 1993)
5.8 An example of representation: The ICD

Two main aspects of representation have been identified so far. The first is the way in which their "representativness" can be seen as an accomplishment. Sociological discussions of how representation in the sciences is accomplished point us in the direction of asking how it is that databases are seen as representations. This was used to develop a list of five ways in which databases are established as accurate and valid. This is the accomplishment of "Wooglar's arrow" - of the connection between representation and represented. The work of Latour led us in a complementary direction. Looking how databases represent the world, eight "devices of formalisation" were discussed. These allow databases to take nearly any phenomenon in the world and represent it in a controlled, ordered format. Formalisation takes the world and represents it in an ordered and meaningful way.

While the next chapter attempts to place these practices of formalism in the context of the study at Narajo, one study by Bowker and Star (Bowker and Star, 1993) brings out how formalisation is achieved particularly well. In their study of the International Classification of Diseases (the ICD) they demonstrate how formalisations are politically contested in a day-to-day sense, and how these must be bridged in building a formal representation for practical use. It is in the breakdown, the debates, and the problems behind making the ICD work, that formalisation in use is exposed.

The ICD is an international classification of disease, currently administered by the World Health Organisation. As a scheme for classifying disease, it has been in use since the 19\textsuperscript{th} century, updated roughly every ten years. As well as being important for epidemiology and medicine, it is increasingly important for the financial and administrative components of medical care. In its simplest, embodied form, it is a booklet distributed to hospitals, insurance companies, health accountancy firms and statistical bureaux. This booklet describes the different types of diseases, and ways of classifying them. Increasingly, it is built into software used to keep medical records, embodied in the structure of computer systems code.

Bowker and Star describe the ICD as a device for co-ordinating highly distributed information and work over time and space. As a device, it becomes itself subject to the tensions between different groups. It is both a common and a customisable object for these groups, since while there are considerable advantages in standardisation, there are also pressures in individual sites to customise it to the practicalities of each situation.

5.8.1 Problems
For epidemiologists, it is important to be able to track diseases across countries over long periods of time. A standardised list is a way of overcoming individual cultural differences. However, while this might seem straightforward it has proved to be almost impossible. Diseases present themselves differently in different countries. An example of this can be seen with stillbirth. Stillbirth is a social category, somewhat religious in its nature, which differs from country to country. If a foetus never breathes, is that a death? At what point can a miscarriage be considered a death? The problem here is of deciding what is and what is not an entity. With regard to the classification we are only interested in recording "deaths" - the only entities are "deaths". To start recording statistics on death, we must make the seemingly simple division between “alive” and “dead”\textsuperscript{46}.

Once the designers of the ICD decided on what was, and what was not, a death they faced a second problem: how to decide on the cause of death. This is a problem of attributing. Statistics may be gathered in different ways. Less urbanised countries might have less time to treat each case. In the USSR at one stage no attempt was made to compute the cause of death in places with less than 10,000 inhabitants. In Switzerland, when the statistical cause of death was made confidential and separated from the public cause of death, cases of syphilis, tabes, dementia and suicide all increased. And in Japan, death by heart disease is often listed as death by stroke, since an overworked brain is considered more honourable than a overworked body.

Another problem was that it was not just epidemiologists using the list - sociologists asked for suicide to be classified, for example, although suicide is not a medical cause of death. Doctors complained, since the classification ‘had no prophylactic value’.

For the ICD these questions over what to put in the list were particularly difficult, since the needs of doctors, epidemiologists and statisticians diverged. There is even a problem with ordering since a cause of death must be decided in cases where there are multiple causes of death.

\textbf{5.8.2 Solutions}

While the devices of decomposition, attributing, clustering and ordering make the ICD possible, they are problematic in use. To solve these problems, or at least make them manageable, that we have standardisation and re-representation.

Standardisation for the ICD has taken place through the use of death certificates with blanks to be completed in a standard way. What is interesting about the ICD use of forms is the flexibility which has been built into the use of forms. A central concern

\textsuperscript{46}There is also an discussion of the constructed, social nature of death in (Grint and Woolgar, 1997).
for the ICD has been managing the local customisation. Rather than create unitary knowledge categories, parallel or multiple representational forms are used. So, rather than describe in Western terms an "imbalance of energy cured with acupuncture", a parallel representation scheme is used to prevent the imposition of inappropriate categories. This localisation has been done by the ICD committee issuing rules for how the list is to be modified. Although control is lost at a primary level, it is regained at a secondary, giving realistic algorithms for working back from the modified list to the ICD itself. This way data in the ICD can be re-represented and manipulated so as to return to the standardised record. The ICD is a complex, globally managed formalism which has been productively maintained for over 100 years. It is an impressive achievement, considering the diversity of claims, needs, and pressures on its design.

5.9 The politics of representation

So far we have discussed the concept of representation and what this can tell us about how computer databases are used. The idea of Woolgar's arrow - the connection between representation and represented - highlights how databases are made into representations. Databases are a 'practical accomplishment', something which can be studied empirically. We have listed five ways in which databases are made to look 'representative'. Databases also formalise the world, and this is central to the form of the representation they present. Formalisation takes qualitative details and by the imposition of standardised techniques, converts them into an ordered and stable form. We listed eight of these 'devices of formalisation', that can change nearly anything into the form represented in databases.

But while the above discussion dissects how formalism is done, and the way in which this fits in with organisations, we have yet to consider the political aspects of formalism. These arguments have been played out with regard to technology in the debate surrounding Suchman's attack on formalisation (issues 2:3 and 3:1 of the CSCW journal). Suchman's original paper (Suchman, 1994a) is a critique of Winograd and Flores' use of speech act theory in designing their "co-ordinator" workflow system. Winograd and Flores' system uses the classification of parts of language in speech act theory to structure communications sent electronically. To Suchman, categorisation is "a technology of control by some parties over others", and she compares the use of speech act theory with Foucault's description of the training of soldiers. Both are parts of the "imposition of regimes of action":

Throughout the history of communication technologies within organisations we find the imposition of regimes of action in the name of individual self-improvement and organisational efficiency. At the same
time, organisational members are subjected to ever more elaborated systems of record-keeping, measurement and accountability. Instead of the emancipating alternative that Winograd and Flores would seek, they seem to offer yet another technology designed to create order out of 'nature' by, as Haraway would put it, 'policing her unruly embodiments' (p187, *ibid.*).

Other writers have pointed out how representations can be used as political devices in gaining power over others. Formalisms have a status as "anonymous truth". Since they delete their author they appear as rational, objective views of "what is going on":

Highly formalised representations seem neutral or objective to many, if not most, people - and the political decisions made in creating them invisible; that there is an illusion of completeness of information because of information technologies, whereas in fact information is highly decentralised and always incomplete; that we may delegate moral decisions or responsibilities to technology in ways that are blind. (Star, 1989)

This can be seen in the supposed 'superiority' of computerised records. For example, trade in Northern Irish beef to European markets has resumed recently after the "BSE scare" of potentially contaminated meat. The ban, however, remains on meat from the rest of the United Kingdom. The reason given for this was that Northern Ireland relies on computerised records of diseases in herds, as opposed to paper ones in the rest of the UK. This was uncritically reported on BBC television news, alongside library footage of magnetic tapes being loaded into large mainframe computers.

This anonymising detaches formalisations from the contingent politics of the workplace. Representations are just "accounts" of what is going on - they have no special *a priori* claim to validity. Some writers complain that this feature of formalisation makes individuals mistake "the map" for "the terrain" (Hayakawa, 1972). This is especially clear with formalisations of work practice, such as business process engineering or computer workflows. There the status of the process diagram *vis a vis* the work is highly contentious, yet they are often viewed as superior to other descriptions (Bannon, 1995). At times this superiority also leads social scientists astray. Poster, for example, writes of databases as a "super panopticon", echoing Foucault's writings on the prison:

Today's "circuits of communication" and the databases they generate constitute a Superpanopticon, a system of surveillance without walls, windows towers or guards. The quantitative advances in the technologies of surveillance result in a qualitative change in the microphysics of power ... the Superpanopticon, is a means of controlling masses in the post-modern, post-industrial mode of information. (p95 and p96, Poster, 1990)
This is, however, to lose sight of the actual use of databases. Poster only mentions one example - a credit database used when he bought a car. Databases are granted extravagant power situated more in their media image rather than an actual analysis of its use

Bowers makes the point that, we should not ask if formalisation is morally undesirable, but instead we must examine individual cases of formalisation to see what is being "silenced" to make the formalisation possible:

our task should be to tell a longer and more inclusive [tales], to enlarge the constituency of agents whose narrations are taken seriously (Bowers, 1992)

Formalisation is not an inherently negative tool. Its evaluation must be made in individual cases. We must not forget the work which makes formalisations possible, or tells stories about the miraculous power of the formalisation. What is interesting is how that politics is carried out in individual cases. How is it that, as Star puts it "We are part of the records we keep". Studying this requires that we descend from generalisation and look at actual cases of formalisation in practice.

5.10 Conclusion

Taking a step away from the fieldwork at Narajo, this chapter has considered how to think about the use of technologies like Notes in organisations. It discussed the notion of "representation" - that Lotus Notes, rather than just being a form of communication, can also be thought of as a computerised record of the world. In attempting to understand how it is that Notes works as a representation, we were led away from the standard discussions of computers and design, and towards the work of writers in the sociology of science.

While we are all familiar with representations such as maps, pictures and even computer databases, the question of how it is that they stand for something is not easily answered. Wittgenstein's remarks on this directed us into studying how it is that representation is done in practice. Wittgenstein offers us a way of understanding representation as an activity, and as something which can be studied empirically. Two writers from the sociology of scientific knowledge also helped our conceptions of representations. Steve Woolgar's work questioning representation in science lets us see that when something "represents" something else, that is a achievement. Work

\[47\] Foucault, however, has also been criticised about his assumption that modern organisations are similar to prisons in any sort of straightforward way (p168, Reed, 1992)

\[48\] Leigh-Star acknowledges this quotation to Gayatri Spivak (Star, 1989).
must be done to make this appear natural. Applying this to the use of databases, we can uncover *devices* for achieving this connection between the object and the representation.

Alternatively, Bruno Latour provides a way for connecting a study of the small scale activities around representations with their wider role. Latour's "immutable mobiles" explain the power of mundane paperwork as an infrastructure of power, as a way of *acting at a distance*. Formalisation has a large role in making these mobiles work, in the way that formalisation can reduce the detail of the world into manageable quantities.

This chapter, then, has taken the computer database and discussed its conceptual role in organisations. One conclusion is that to understand representation one must look at actual situations of *representing*. It is only in those situations that meaning is actually achieved and sustained. The next chapter applies this to the activities of representing at Narajo Oil.
Chapter Six: My timesheet right or wrong

The use of two Lotus Notes databases at Narajo Oil
6.1 Introduction

As mentioned in chapter two, research into the design of databases is an active field, with many journals, conferences and courses. This is in distinct contrast with studies of how databases are actually used and incorporated into the workplace. This topic has received relatively little interest by researchers, with only a few studies published. It is as if the use of databases is considered something of an irrelevancy with regard to how they are designed. This is not a problem specific to databases. Nearly all computer applications have received far more attention technically than consideration for how they are used. Computer science as a research field seems to be almost exclusively concerned with questions of a technical nature, ignoring issues of use. However, as was shown in chapter three, this is not to say that this topic is not of interest. Indeed, it is in looking at how computer applications - such as Notes - are used that we discover examples of "creative use", of technology use as an original and studyable activity.

Accordingly, this chapter continues our study of use by taking the conceptual points made in the last chapter back to Narajo. Looking at two of Narajo's databases in-depth brings out the practices of formalisation, Woolgar's arrow and achieving meaning, in the work of Narajo's staff. There the concepts can be seen in the work the staff did to get Notes working successfully.

The first database to be studied is the Narajo "timewriting" system (section 6.2). This database was used to record the hours staff worked on different company projects. Timewriting was based around an electronic "timesheet", a form used to account for the time worked by staff in the terms of financial codes. This timesheet formalised the working day using the devices of formalisation listed in the last chapter. Hours were classified, divided, ordered, embodied and accumulated. Looking at how the timesheet was used, however, reveals more than just formalisation. Timewriters (staff who completed timesheets) balanced the need for the timesheet to appear accurate, with the amount of time spent completing the sheet, without needlessly embarrassing the author. Timesheets were "reasonable accounts" in that the aim was to balance the different contingencies of timesheet completion. The meaning of timesheets was thus not a simple one to one representation of reality, but rather a "worked up" account of the working day.

While I was at Narajo the paper based timesheet system was replaced by a computerised Notes database, the paper timesheets becoming computerised forms. With this move came changes in the way the timesheets were controlled. Electronic timesheets could be programmed with restrictions that were not possible with paper
documents. These controls imposed a division of labour by forcing the timewriters to pick valid financial codes rather than leaving that job to finance. Other controls standardised the timesheet process and made the process more ordered. Finance staff could point to these controls, along with the anonymous nature of the computers calculation, as evidence of the reliability of the timewriting system. These controls strengthened "Woolgar's arrow" (section 5.5.1) because the representativeness of the numbers the Notes system produced could be shown by demonstrating the controls which prevented invalid information.

The second database to be examined, the "Quarterly Reports database" (section 6.3), highlights similar issues. This database was used to track the progress made on different IS development projects, producing a report which was presented to management every quarter. Its role as an account of work to management, and the nature of its design, meant that in use it was somewhat contentious. The database framed work in an inherently negative light, in that it detailed in its reports only how much projects were behind time, how much they had 'slipped'. This took control away from staff in how they presented their work, since they had no avenue for explaining why a project had slipped. This caused considerable resistance to its use. Since this account was formed in a manner the staff took exception to, the database became a political object. A related problem was that the database, as a secondary account of work, added an extra burden - maintaining the representation. Updating the representation was secondary to the work done on projects. Updating the database was neither part of the routine nor necessary to get a job completed. It was "out of the loop" and only completed because of continual management pressure.

Following the second example we leave Narajo and undertake a short reflexive 'play' on the status of this report. For while the last chapter only talked about representations at Narajo, this report itself is also a representation. Like the databases described, ethnography can be described as a process of "formalisation" and the chain by which field work becomes the completed argument is another case of "maintaining Woolgar's arrow". Over the last ten or so years the truth claims of ethnographies, such as this one, have come under "deconstruction". As veteran ethnographer Van Maanen puts it, the call to ethnography is now "J'Accuse!" (Maanen, 1995). Connected with this is the claim of writers in the sociology of scientific knowledge that to analyse a setting in constructivist terms is to implicitly ironicise the actions of that setting, since the status of a sociological study is being positioned as a 'superior' account of that setting. This is the problem of ontological gerrymandering (Woolgar and Pawluch, 1985): how does one criticise others' truth claims while claiming a status for one’s own? If to study the construction of databases inherently ironicises the account in those databases, must we also ironicise our own account?
To find a way out of this dilemma, I suggest that although this ethnographic account can be deconstructed just like the database at Narajo, this does not affect its validity. Both members' accounts and sociological accounts are worked products, produced as part of a practical endeavour. Their validity is something that is established and maintained within that endeavour, and so these can only be judged within that endeavour. This stance emphasises that we should "level the playing field" between members' and academic accounts. This preserves a way of answering the original question posted in chapter one: "what is going on?", while still acknowledging the 'constructed' nature of any answer to that question.

6.2 The timewriting system

6.2.1 What is timewriting?

Nearly every member of staff at Narajo had to complete a timesheet listing how they had worked that month. This information was used for a number of purposes, but primarily to charge other operating companies who worked on shared oil fields. Since oil fields are often operated by more than one company, there is a need to exchange money between the partners for the hours worked by each company’s staff. This was done by allocating each oil field a financial code, and staff ‘writing time’ against the codes for each field on which they had worked. Codes would also be used to track time spent in training, meetings, and so on.

The paper timesheets (see figure 6.1, page 174) were designed so as to break down hours worked on a day by day basis. Staff were asked to write valid finance codes along the side (end column), a brief description, and then fill in the hours worked on the grid. Once the timesheet had been completed, it would be sent to the timewriter's supervisor for approval, and if it was approved it would be forward on to finance. Finance would type the hours on the approved timesheets into the centralised Oracle financial computer system, and the hours worked would be calculated in the terms of each company department and cost code. Timesheet that were not approved would be sent back for reediting, and then back to the approver again.

6.2.2 Timewriting as a formalisation

The standardisation of time has been one of the least acclaimed, but most important, achievements of the modern age. As Mumford puts it: “the clock, not the steam engine is the key-machine of the modern industrial age” (Mumford, 1934). The timesheet achieves something remarkable: it reduces the work at Narajo, in all its

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49 Members of a few departments, such as IS and administrators, did not have to complete timesheets since their services were not charged out to other companies.
complexity and variety, to a small number of predefined codes\textsuperscript{50}. Yet timesheets are themselves fairly mundane. How they are used is "common sense", to the point where there has been little serious analysis of how they are used or completed\textsuperscript{51}. This is similar to the lack of attention that has been given to other 'mundane' organisational devices. The above discussion of Yates' study of the office memo (section 5.7.1) showed how the development of mundane organisational devices, forms, reports, timesheets and the like, was not simple and straightforward. Indeed, they played an important role in the "systemisation" of the organisation, of organisations becoming "organised". As Latour (section 5.7) points out, these mundane devices play an important role in making modern organisations possible.

The timesheet is an excellent example of such a mundane device since while the details of how it worked might seem rather prosaic, it is used to achieve something quite grand. Timesheets standardise time and produce a view of the work at Narajo as organised, sensible and straightforward. This is the work of "achieving organisation", of producing a view of the organisation as ordered and sensible in an organisationally appropriate way. The order is extracted and displayed for all to see. Looking at how this is done reveals "artful practices", ways of using the timesheet correctly so as to produce this ordered account.

\textit{Decomposition, coding and standardisation}

Timewriting formalises \textit{activity}, so the first question to be decided when completing a timesheet is what activity should be put down on the timesheet. What is timewritable work and what isn't? As one timewriter remarked:

\begin{quote}
"Although, say, rearranging my office might be admin I will not actually bother timewriting this."
\end{quote}

(I14 t/w)

Staff had to decide what should and should not be put down on their timesheets, balancing different contingencies. Staff would not timewrite activities that could be considered "frivolous". Seldom has a timesheet been handed in which included activities such as "making cup of tea", "going to the toilet", or "gossiping about colleagues". For example, it would be ridiculous to have a time code for "extra long lunch hour" since no one would seriously use such a code. But this is not to say that

\textsuperscript{50} (Zerubauel, 1979) discussed how the timesheets in the hospital he studied formalised individuals to the point where it made sense to use terms such as "half secretary".

\textsuperscript{51} Studies of the formalisation of time such as (Roth, 1962; Zerubauel, 1979; Strauss, Shizuko et al., 1985) have discussed timetables as ways of structuring, rather than accounting for, time.
such events never happened. The IS department took a whole afternoon for its Christmas lunch (fn 20/12)52. It is not just that these activities are too short to be worth timewriting, rather it is that the timesheet was an "account" of what went on. Other factors and conventions, such as the time needed to complete the timesheet, intervened. Staff had to choose what activities to timewrite that would help produce the timesheet as an appropriate, sensible and relevant timesheet. How these decisions were made can be seen clearly in how staff decided what financial codes they used.

The individual activities on the timesheet were coded using finance codes. This brought together all sorts of different activities and coded them not in terms of their inherent characteristics, but in the terms of a predefined standardised coding. This standardisation made the work done by all the different people in Narajo comparable. The differences between different jobs were ignored and the work described in terms of similarity. For this to work all staff had to use the same finance codes. This list of codes was distributed to staff via the company notice board (section 3.4.3) with the codes were continually changing, being “closed” as projects finished, or opened as new projects started. Enforcing use of only valid codes was a major problem for the financial staff - something which motivated the move to the electronic system. Before the electronic system, staff would "write time" to codes which had been closed, or not even bother to write down financial codes, causing much frustration for finance staff. Accordingly, one of the original specifications for the electronic timesheet was that:

On submission [...] each of the codes should be checked to see if they are valid. If any are not, then the user should be told so, along with a list of [the] codes which are invalid, and asked to contact their finance representative.
(t/w 10)

The financial codes used had three parts. To be able to track back into individual oil fields (for charging the other oil companies), the first part listed the location of the oil field (the LOCation number). Then a second code was given for the projects being worked on (the AFE number, Authorisation for expenditure on that project), used for tracking the different cost accounts. Lastly, the codes included a short description of what the work was. The coding then, categorised activity three times - once by LOC, then by AFE, and then by description. A code might be “11143 1003 Administration”. The finance staff made use of the LOC code for charging other companies, the project code gave the project managers some grasp on their project.

52 Returning to the office after this boozy lunch might have been more dangerous than productive.
costs, and the description gave supervisors a view of their staff's work, training, holidays and so on.

For the timewriters, which codes to allocate work to was ambiguous. Consulting colleagues solved this ambiguity and in this sense, code definitions were collaboratively produced and maintained, and not just read from the given list. In my notes from interviewing timewriters:

To get the codes he goes into the noticeboard copy of the codes. Going from description to code can sometimes be difficult. P thought this was because sometimes a job could fit more than one code or because finance had split a job into lots of codes for some reason (AFCs for different codes, for example). Usually P gets to the right code, but sometimes he splits the amounts (hours) across a set of codes equally when he doesn’t know what to do.

Codes, this is what takes up the most time. J said that she looks at the codes in the notes dbase or does legwork - asking a colleague or finance. Said she isn't sure what to account 'general' meetings to. She's done it to 9000, but isn't sure if this is right. Nobody has complained to her

"Sometimes you have to ask a colleague to make sure something is the right code"

Main problem is trying to classify stuff (hours). His activities often "bleed" between two or so adventures (codes). Usually in that case P just takes an "executive decision". Also, what about presentations which might help more than one project? He normally just puts it in - he doesn't put any stuff into admin.

Sometimes work spanned more than one code or would not fit any code at all. The first quote indicates one technique for dealing with this - if an activity fitted more than one job, then the hours would be divided between two (or more) codes and allocated equally between them. This made the distribution of hours "correct", in terms of financial accounting. This shows that what is a "correct" timesheet is defined not out of some external notion of a verbatim account, but as a local judgement. The issue is what is correct and appropriate to this timesheet.

6.2.3 Timewriting as an account

Most timewriters waited until the end of the month to complete their timesheets. Some staff wrote down details in their diary, day by day. Others took rough notes at
the end of each week. When it came to completing the timesheet, these notes would be used to help compose the numbers. From my notes again:

P showed me his diary which had a description for each day what he had been doing and at the bottom a crossed off box he used for his timewriting each day. The bottom bit consisted of a description and a number (usually 1, 1.5 etc.) for the hours. Descriptions were along the lines of "insurance", "Thames", "Winch farm 1". Descriptions don't hold all the info needed to get to a code, but P "remembers" the details when he sees the codes. Said that if you didn't keep a track you'd get into an awful state. Then, at the end of the month, he goes into the system and types the numbers into the spreadsheet.

(116 t/w)

J fills details into her filofax. [...] She says "timewriting is a partial account of my activity - its sometimes downright incorrect."

(115 t/w)

If one did not bother to take specific notes of hours and activities, then the account would be taken from memory or by browsing through your diary. In composing the final timesheet these numbers would be 'juggled' so as to appear as a 'fair' account. Since supervisors approved timesheets, concerns of presenting oneself as having correctly appropriated one's time became relevant. One timewriter spoke about how he often worked weekends, but he didn't write time at weekends - he would 'juggle the other figures':

P works more than 8 hours normally, anyway, but he only t/w 8. Any other activities get squashed outside the 8 hours. E.g. he will never timewriting for working at weekends. Said he wasn't interested in showing that he worked long hours.

(113 t/w)

The timewriter here seems to want his timesheet to appear like other timesheets, none of which had any hours written on the weekends. The concern is with consistency between timesheets - for the timesheet to appear "just like the rest". The juggling done for this is apparent by glancing through the timesheets. Timesheets show a consistency in the number of hours worked on each day. Although timesheets had different hours worked on each day for different projects, this was 'juggled' by the timewriters so that there would be a consistent numbers of hours spent working each day. Figure 6.2 (page 175) shows some of the hours worked per day for a small sample of timewriters.

But although the timesheets show this regularity, staff did not seem to work strictly nine, eight, or eight and a half-hour days. As the quote above shows, some people
even worked weekends. On mentioning this to the timesheet administrator from the finance department I got this response:

D came to see me to check up on progress [...] I mentioned to him I had found some “interesting things” about the timewriters - e.g. that people worked on weekends and didn’t put the hours down. D. sort of accepted this saying he already knew it. “Yes, it’s a problem.... I suppose it’s just one of those things”. I asked him if this was OK and he seemed hesitant to say that it was or either to sanction any repair. It didn’t seem a problem to him.

(9/10)

The nature of the timesheet as a worked account was accepted by finance as unavoidable. That is, the timesheet had effort put into its completion so that it represented a “normal account” of time, typical periods, “expectable fluctuations” and so on. That the timesheets were accurate (since the payment of money depended upon them) relied upon the work of the timewriters to “work up” accuracy. It was important the timesheets were seen as an accurate account of what staff worked, since this was what "Woolgar's arrow", the link between the timesheets and "the work" depended on. If the timesheet system was not considered reasonably accurate then the finance department would have had problems justifying the transfer of money based on it.

6.2.4 Maintaining Woolgar’s arrow

Timesheets were, to a large extent, a product of the structure of the system. Since people were asked to write time to the listed financial codes, a change in codes would result in a different account of people’s time. This meant that there could be no simple "checking against reality" for the details in each timesheet. Questions of accuracy could not be judged at the level of the timesheet, since there was no other way of measuring the hours that people worked.

Accordingly, those involved in the timesheet process realised that the important issue was to get information into the system that would be visibly accurate. A 'reasonable' account for timewriters was one that was a believable account of the time they worked, one which management would approve with no problems. For the finance personnel, a 'reasonable' account was one that would in turn pass the checks of any auditors who would look at the process. Woolgar’s arrow depends upon the timesheet being visibly accurate, that accuracy in turn coming from the timesheet being sensible, checked, routine and adequate for the task at hand.

To pass the scrutiny of the external financial auditors, those who ran the timesheet system could point at the mechanisms of the timesheet process, the computerised
checks in the system and the approval by supervisors. Finance staff would also check the timesheets themselves:

**Email Message from timesheets co-ordinator to N**
*Date: 06/08/96  
Subject: Timewriting*

Thanks for your timesheets (at last)!
One query though, you have allocated all your time to Gas Marketing. Is this to do with the Gas Marketing Project to set up procedures for trading under short term contracts, or is it related to marketing of gas from our current fields. If it falls under the second category we will need to break the time down according to which field the marketing activity was for [...] Thanks

**Email message from N to timesheets co-ordinator**
*Date 06/08/96  
Subject: Re: Timewriting*

Neither!
The gas marketing project must be Agnus’s timewriting code for Short Term Marketing (or Trading). The Gas Marketing work I’m doing relates to new fields. [...] It is impossible for me to split it up.

*(scribbled at bottom of message by timesheets co-ordinator)*
Ok, this basis please enter and in future code all gas marketing time to 100% for Nigel, Anna and Sue
(t/w 5)

The timesheet co-ordinator took the job of getting hours allocated to the correct codes seriously. Part of this job was displaying that this was being done (the email quoted above was found attached to the file of archived timesheets, kept to be shown to the auditors). This public validity was important to the finance staff, because it was crucial to maintain Woolgar’s Arrow. Both the paper and electronic systems were specifically constructed so as to invoke checks on the validity of timesheets and to make that checking visible. Every check demonstrated to the users of the system, the financial staff, and the financial auditors that the system was “representative”.

In the paper system, the process of entering timesheets included checks by both finance and approvers before the hours were entered into the central financial accounting system. As I was told on my second day working on the project, supervisors look at timesheets because they "like to see what staff have done - 'do they look reasonable' " (29/8), although what is ‘reasonable’ changed from situation to situation. It was admitted that although these checks were at best fairly cursory they were important in asserting that only valid timesheets were entered into Oracle. In a
similar case, Harper described financial report checking as a case of "looking for the right numbers" (Harper, 1988). Each rejected timesheet added to the authority of every approved timesheet since it underlined the fact that timesheets were checked. Timesheets were very rarely rejected but the possibility of surveillance was enough to ensure that timesheets were 'reasonable' accounts.

When the system was computerised, the computerised system contained many different automatic checks on timesheets to add to the reasonable-ness checking by the approvers. Finance were concerned to get as many automatic checks as possible on the timesheet (listed in table 6.1), since every check helped to assert the claims of accuracy. When demonstrating the system to finance the main point that was asserted was that:

"this system has enhanced controls because the controls are computerised. Just now an approver can scribble anything on the timesheet"

(24/10)

With an electronic timesheet it is impossible to write outside the boxes on the timesheet. Moreover, the system was designed with as many computerised checks as possible so as to be able to demonstrate how the mechanism of the system would enforce the data's reliability. As one member of IS put it: "finance are just stickers for any sort of computerised control system" (23/10.1). Automatic controls help to establish the accuracy of the data – "Woolgar's arrow". The controls on the timesheet included:

- User name (the person who the timesheet is for) only pickable from list of timewriters.
- User name only pickable if have timesheet to complete for month.
- User name checked to see it isn't blank.
- Approver only from list of approvers.
- Approver not same as user name
- If timesheet completed on behalf of someone, check to see that approver isn't same as completor
- Date after the date when the timesheet system launched
- Date before the next month
- User hasn’t already completed timesheet for month
- Organisational code filled in
- Timesheet contains at least one valid code
- Codes on timesheet valid for this month
- Only allowed to pick valid codes
- No day has over 24 hours
- No letters in the hours, only numbers
- No numbers less than zero in the hours
- Only admin have access to administration views
- Only approvers and finance staff can see broken out codes
6.2.5 Changing the machinery of inscription

While at Narajo I worked on the project to change the timesheet system from paper to Lotus Notes. This was a "change in the machinery of inscription" - a change in the technology which was used to embody the timesheets. This change in machinery created something that on the surface was quite different, yet which made use of many of the same representational practices of the paper system.

Paper and computers

Paper records are physically embodied, something which makes them tied to one place. Their portable nature means that they are often to be found on peoples desks, in the post, on the floor, indeed just about anywhere in the office. They can be duplicated, and with some paper files (carbon copy forms) this is a natural part of their life. This embodied physical nature makes them particularly good for working collaboratively. Research done at Rank Xerox (Harper and Sellen, 1995; Hindmarsh, 1995) has demonstrated how paper is particularly effective for face to face work. One can pick up a page, pass it to someone else. Fold it, throw it, scribble on it - techniques which can be used in collaboration.

Alternatively, computerised records, exist in electronic form in computer databases or spreadsheets. This makes them mobile in different ways, to the extent where they can be accessed anywhere a computer can. While this makes them easier to distribute, the loss is some of the interactional devices enabled by a physical embodiment. One cannot fold a computer database or use it as an interactional prop so easily. A computer record is also not as physically portable. To overcome this, they are often printed out onto paper. This enables the computer record to be altered, scribbled on and generally serve the role of a paper record.

Unfortunately, paper cannot be automatically updated, unlike computer databases. When copies are distributed and changed, they must be recentralised, compared, merged and then redistributed:

A: Personally... I'm a fairly heavy word, excel not so much. Programs, big documents, it's all done on word - diagrams. (Shows me a standard drilling document.)
B: Does just you work on it?
A: It varies.... there's a lot of input, but one person controls that... send it round everyone normally in paper form.... it works best.. if you give people two or three days read it and then have a meeting. Very rarely do you ask for people to put their comments on it electronically. Because... it's hard to resolve one set of comments with another. They may well...
have conflicting information... these things are resolved round the .. round the table.
B: Better to hammer it out?
A: Oh yeah..... So I know there's this new feature (in notes) where you can send stuff around sequentially.... I wouldn't use that much.

(124)

In this extract, a drilling manager talks about how he organises collaborative working on a document which is regularly produced. Notice that the way the interaction is organised fits the distributed nature of paper documents. Comments are resolved face to face, where they can be effectively merged. A computerised version, which might allow comments to be added would not support the need for centralised co-ordination and discussion in bringing all the comments together. The process of working on the document has been organised to fit the properties of paper. A change to a computerised version would just cause disruption. However, in other cases, this distributed nature of paper led to confusion. A security guard printed out a copy of the emergency contact phone numbers and, had used this in an attempt to contact support staff one weekend. While the phone numbers had been updated on the Lotus Notes system, they had not been updated on the paper copy and the security guard failed to contact the required member of IS.

The way the various telephone lists were used at Narajo also indicates something of the play between electronic and paper sources of information. Their were two telephone directories on Lotus Notes - one for the local British company (around 400 numbers), and one for the whole world-wide operation (over 4 thousand). About half the staff members I interviewed printed out the on-line local telephone directory, rather than access it on-line. Although it would not be dynamically updated, it could be quickly found and browsed:

"I always print an updated copy of the address book.. I find it very inconvenient to keep flicking into (the notes database) it. At any one time, you can't have all these things open... so you'd have to keep closing your email... I find it easier to print it out."

(139)

Rather ironically, this negates the very purpose of Lotus Notes information databases - to avoid paper copies. Some staff even when to the lengths of preparing localised copies of the telephone list, with only the phone numbers relevant to themselves and their group. Alternatively, the world-wide directory seemed to be preferred on-line, since its searching facilities made it easier to use than the thick paper version. Individuals made their own decisions on whether to manage their information in paper or electronic form, balancing the different properties, whatever the form dictated by the IS department.
Paper and timesheets

The new timewriting system forced timewriters to fill in their timesheets on computer - paper copies were not allowed. All the paper forms were computerised along with the timesheet approval process, data flows into the finance system and so on. Whereas previously staff had signed forms and put them into the mail for approval, now the forms were electronically signed and merely moved about on the Notes system (figure 6.3, page 176).

At the heart of the old paper based system was a physical document - the timesheet. This would be printed out and passed from person to person. That it was your turn to do something with the timesheet could be seen by the fact that you physically had the timesheet on your desk. In the electronic version this was replaced by a change of state within the computer, which was not as publicly visible. To compensate, the computer system sent email messages automatically when a timesheet changed.

But while the paper system 'prompted' with a physical document, an email message was less permanent and could easily be deleted. Paper based workflows, such as timewriting, have the paper document as a symbolic "token" which is passed around. This 'token' chains together the process. Computer systems do not have this - all the movement goes on invisibly within the computer. As can be seen in figure 6.3 (page 176), there is nothing that chains together the two parts of the computerised timewriting workflow. So that timesheets did not get lost on the system it was important that finance staff could track the status of timesheets and 'prompt' those who had forgotten about, or lost their timesheets53.

A second problem was that while a paper document automatically has a quite sophisticated social form of access control, this must be simulated in some way with the computer version. With a paper document only one person has it at one time, so access to the document is physically controlled. It can be "shown" to someone, while not actually giving them the document, or it can be passed to someone who you think should have the document, and you can ask for the document back later. So with the paper timesheets they were "held" by one person at a time, and physical ownership gave access control. With the computer version, this access control had to be explicitly implemented. This led to some design problems. Timewriters at first were only allowed access to their own timesheet. But unexpected situations arose, such as a secretary completing a timesheet for their manager, and the timesheet being passed

53 (Harper and Sellen, 1995) discuss a similar problem with electronic documents in that they have very little "symbolic" power. Sending someone an electronic document is very different to handing over a printed copy.
to the manager before being submitted. These sort of situations, with access needed by different people, had to be catered for while still protecting the electronic document from unwanted access. Solving this proved to be one of the biggest design headaches.

**Paper and computers: Practices and rules**

Computer systems often innovate work by create new ways of working (Zuboff, 1988; Straussman, 1985). However, they are also often attempts to embed existing ways of working into the computer. The Notes timesheet system shadowed the paper system quite closely, so many of its features were attempts to "automate" manual practices. An example of this was the way the computer filled in new timesheets with details of who you were, what your department was, and who your supervisor was. This was an attempt to automate the manual completion of these details on a new timesheet.

There is, however, a major difference between a computer doing something and a person doing it. This is the difference between "rules" and "practices"54. When a computer does something, it mechanically follows a rule, something along the lines of "if <new timesheet> then <complete name, department, supervisor>". This rule is an attempt to simulate what people do when they start a new timesheet. However, filling in your name at the top of the timesheet is a *practice of use* rather than being a prescriptive rule. Staff did not mechanically go through the process of filling in the details at the top of the timesheet. Instead, they were aware of the 'rules' about these details on the timesheet, and 'orientated' towards those rules. We are not 'cultural dopes'55 where our actions are the product of simple rules. Rules do not generate behaviour, as they do with computers, rather, they are *oriented* towards. Because we use rules as resources for organising our conduct, we also attend to other features in our settings which may influence our actions (Suchman, 1983; Suchman, 1987).

Since users were aware of this, the rule about the name on the timesheet could be orientated to for practical purposes in situations such as completing the timesheet for someone else, or completing the timesheet with a false name for testing purposes.

The original design failed because staff needed to be able to change the name on the timesheet, as they would often complete timesheets on behalf of other people. An ability to change the name was needed. The design had taken the completion of the name box at the top of the timesheet as a *rule*, rather than a *practice*. However, even

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54 This argument has been pressed most forcefully in (Button, 1990; Button, Coulter et al., 1995; Button and Sharrock, 1995), and debated by (Frohlich and Luff, 1990; Fordham and Gilbert, 1995).

55 Garfinkel used this description to parody conventional social science conceptions of the actor, where individuals are like puppets controlled by giant socio-economic forces (Garfinkel, 1967).
the new design caused some problems. Since the rule about names at the top of timesheets was something orientated to, it meant that test accounts, for example, Fred Flintstone, could be used when testing. No one would seriously think that the timesheet was for Fred Flintstone. The computer, however, treated the timesheet like any other. When some of the data about “Fred Flintstone” got from the test to the live system, this caused problems.

Other mishaps arose because of the difficulty of changing program code. With the entry of the details on the timesheet, something which was 'part of what we do' had become part of the computer's code. However, human practice is an inherently changing, intangible phenomenon. It is only as permanent as its last enactment56. Small changes to practice are a continual feature of adjustment to situations (Suchman and Wynn, 1984). With computers, any change to software must be implemented, tested and rolled out. Small uncontroversial changes to human practice can be made by just asking someone to change what they do57. With a computer system small variation could involve a major rewrite. It has been said that computer software is “society made malleable” (Cooper and Woolgar, 1993). But for the purposes here, it was more a case that computer databases were practice made physical, in that the practices of timesheet use become translated into computer code for controlling how timesheets are entered, distributed and so on. While this can help efficiency, it can also get in the way of flexibility (Berg, 1998).

For some aspects of the design, however, the very fact that computer rules, unlike human practices, were hard to break was very important. To the finance department the key advantage of the system was that it ran extensive checks on the codes to ensure that they were valid. These controls imposed a division of labour compared to a paper form. This division of labour forced the timewriters to pick valid codes, rather than leaving that job to finance. In this case, that the rules could not be broken was a central advantage for moving from the paper system58. This is the irony of

56 This is not to assume that structures of action are unreal in some way but rather that these practices are an "ongoing, practical accomplishment" of practical action (Garfinkel, 1970). For more in-depth discussions of the notion of practice from different perspectives see (Button and Harper, 1996; Engeström and Middleton, 1996). Note also (Turner, 1994) critique of the use of the notion of practice away from the sites of its actual use.

57 Indeed, every enactment of a practice involves some sort of adjustment to the situation.

58 This is analogous to the situation with queuing in high street banks. The queue is a human practice par excellence. It can exist over days, even thought the people in the queue can change any number of times. To skip a queue is to break a human practice - someone that can cause great annoyance. Queuing is a common part of using a bank, since there are often more customers than staff. A recent development has been the attempt by the banks to arrange what type of queue forms. Bank tellers' windows often now have a partitioned walkway that leads up to the window. The walkway is like a funnel, forcing people through the one opening to the bank tellers, rather than forming individual queues at each window. By the addition of some partitions, the actions of those coming into the bank are reshaped. We are forced to queue in the desired way, without anyone saying a word to
computer databases: their advantages are also their disadvantages. That the electronic timesheet could control behaviour was its key advantage, but this made it inflexible in different situations\textsuperscript{59}.

(Markus, 1983) gives an insightful discussion of a similar example of a computer being used to enforce a division of labour. In that case, one organisational grouping used the design of a new database system as a way of forcing work onto another organisational group. The different reactions to the system were shown as originating from this division - one group got less work and more control, the other more work and less control. Although the staff in the losing group fought against the system - and attempted to sabotage its use - it still successfully controlled the division of labour. Markus' paper shows how the design of databases is not a neutral activity, but instead one directly tied into questions of power, organisational politics and who does the work. These topics are put into more relief with our second example discussed in section 6.3.

6.2.6 The working day as a social production

In the last chapter we discussed at some length questions of how it is that a database can appear to refer to the world, to tell us something about the world. With the timesheet system, we can see how there was not a simple one to one mapping between the contents of the timewriting database and 'reality'. Instead, the meaning of particular items in the database came from how they were used in the process for which they were designed.

The meaning of a particular part of a timesheet could not easily be connected with a given task that a timewriter had done. Instead, the meaning of the timesheets came from the way they were used as part of an organisational process for "ordering time". One could take a number, which was put into the Oracle computer system, and ask "what is the meaning of this number?", and try and trace it back to the hours worked by a member of staff. One could then claim that the "meaning" of this number was that this person had done such and such work. But this would be to wrench that number from the context in which it is used and attempt to impose meaning on it. As our discussions of "reasonable" timesheets shows, there was no simple connection

\textsuperscript{59}From the report into the London Ambulance Service's failed attempt to computerise their dispatch system:

"... satisfactory implementation of the system would require changes to a number of existing work practices. Senior management believed that implementation of the system would, in itself, bring about these changes". (p5, Report of the inquiry into the London Ambulance Service, 1993)
between referent and reference. To find meaning we do not need to trace where numbers come from, the numbers have sufficient meaning in how they are used. The system was designed as a way of "accounting" for time, numbers were entered into the system and manipulated by that system. That is the meaning of each entry, how it was used as part of the timewriting system.

The key accomplishment of the timewriting system, however, both in the paper and electronic form, was the way that it displayed Narajo as organised. The process made Narajo appear accountable and sensible. So long as the validity of the timesheet system was maintained, the system could be used to represent the work at Narajo in new, more distant terms. Figure 6.4 (page 177) shows how the chain of representations would move the details of work further and further away from actual timewriters, making the information appear authorless, more automatic, more valid and less contestable.

Each stage of this chain combines different representations producing "hybrids" (Latour, 1988) - calculations which bring together different numbers. The hours worked are transformed from "by person" to "by department" to "by the company as a whole". This reinscription brings together hundreds of different timesheets and threads them into an ever more powerful new account. It is more powerful because the contingencies and problems of individual timesheets are hidden in the authorless numbers for each department. The final step in this "representation building" is when the timesheet hours are exported into the Oracle database. The Oracle financials system was jealously controlled by the finance department since it was the details in Oracle which cause real money to be paid out. Oracle had the status of being the "final representation" - the bottom line. Paying money was a serious business, and one where accuracy in the timesheets was important. It was not a simple case of impression management - the timesheets were accurate, for the purposes designed. In this way the timewriting system helped to produce a view of Narajo as sensible. It displayed the order of the work which was prevalent throughout Narajo.

6.3 Quarterly Reporting: “The project slip database”

The second database we will look at in detail is the quarterly reports database, used for reporting to higher management the progress made on the different projects undertaken by the IS department. Completing the database involved putting in the details of how much each project had ‘slipped’, what new projects were being undertaken and which projects had been completed. The views from this database would then be printed out and presented to board level management to show the progress of the IS department in the last three months (figure 6.5, page 178)
6.3.1 Quarterly reporting as a formalism

Even from this brief description it is possible to see the first steps of formalisation at work. Somehow, all the individual actions of the analysts had to be decomposed, coded into individual 'projects' (entities), and dates for completion and progress (attributes) given to each of the projects. As with the timesheets system, this formalisation was not a straightforward task. The question of "what are the projects" was not immediately obvious, but came to be solved in use:

A: Basically, you put something into the database, type in a description and you tell S about it, he mucks around with it to word it how he wants.
B: How do you decide what to put in it?
A: That's a good question [...] A: The big things, the big things which you are working on. I mean, how we work is different from the people over there - the things we work on last longer. 2/3 man days - major projects. Not just fixing someone's CD - that's not interesting. Like - I can go and put a CD on a machine for someone, or go and fix a problem with a bit of software - but that's not very interesting.
(QRI10)

Described putting tasks in "it's a bit arbitrary". A task would either be put in by S or M, but he couldn't remember who had put in the main task he was working on (finder upgrade). Said that only the big tasks you were working on went in, since no-one was interested in fixing a machine. Talked about how you would normally put a description in, Steve would muck around with it and say "No, you want it this way" and change it a bit.
(QRI12)

The projects which were entered into the database were "cleaned up" by the IS manager, S. Already, the presentational issues of the database come into play, as S decided how best to describe the IS projects to upper management. The database, then, did not simply represent the projects which IS were working on. Work did not easily and unproblematically cleave itself into individual projects. Instead, IS staff produced a collaborative description crafted for the purposes of producing a 'reasonable' account of what was being done, one that could be easily compared, was simple and understandable.

Once our phenomenon has been decomposed into entities (projects in this case), attributes are allocated - predicted completion date and current progress. Projects can then be ordered depending on who is working on them, or by when they are to be completed. All the work involved in the department becomes ordered and catagorisable. Analysts are shown as "owning" projects, even though they might be the work of a group of people, or even the whole department.
6.3.2 Quarterly reporting as an account

Before the end of each quarter, in the IS weekly meeting, the development manager K would attempt to force the analysts to complete the database:

K [the applications manager] reminds everyone about quarterly reports ("Done that" says P)
(23/9.3)

K gives a little speech about Quarterly Reporting: "I know no one likes to do this, but you're going to do this. I know nobody likes to do planning... if it doesn't get done then you'll have to handle S [the IS manager] ... I don't mean that as a threat"
(30/9.3)

What caused the most difficulty was that the quarterly reports database focused on representing how much each project had slipped (figure 6.5, page 178). S, the manager who had designed the database, thought that this was the most important information to present to upper management: simple, quick details of which projects were planned and what projects were behind schedule. And since reporting was done to management on a quarterly basis, the database marked the progress of projects in terms of year quarters. The aim was to have a succinct display of the departments progress.

Analysts confessed to me that they found it frustrating to have a project that was just about to be completed, yet because it missed the quarter end by a few days it would be presented as having slipped a whole quarter. Moreover, the focus on just how much each project slipped did not allow the analysts to account for their actions. A project could have slipped through no fault of their own (for example, by delays from a vendor in supplying a new version) but there was no avenue to present this information (figure 6.5, page 178). An analyst could work hard on a project but since the only information was the slippage, there was no way of showing this:

"Whereas I can spend a lot of time on a big project and it doesn't show up on this database. It's not as if we're sitting around doing nothing."
(QRI10)

A solution was to "hack the description". This involved editing the description of the project to include an explanation for the delay. This undermined the form of the representation by hijacking a commentary onto the description of the project:

[they've added an extra field now]
"Before that people would just go in and add something to the description - even though this was not what it was intended for. They hacked the description."
A "reasonable" account

Again, as with the timesheet system, the notion of a reasonable account is being used. What is a reasonable account? This depends on who the readers and the writers of the information are. As Sacks observed regarding conversation, speech is "designed" with concern for how it will be heard (Sacks, 1992, VII lecture 2). In deciding what we are going to say, we specifically take into account who our audience is, what they will understand or not understand, and the contingencies of the situation. We may talk about topology with both mathematicians and plumbers, but it is unlikely that we will do it in the same way.

Reasonableness is what is believable and understandable. With the quarterly reports the analysts wanted to demonstrate that their activities were orderly, efficient and correct. However the database presented an incorrect view - it would emphasise their work as slipping or inefficient. To the analysts, who wanted to demonstrate their professionalism, this was highly frustrating.

Fortunately for the analysts, the quarterly reports database was not a unique representation of the department’s progress. It existed along with other competing representations - such as the verbal descriptions given by staff or the existence (or otherwise) of the planned new applications, upgrades and so on. This meant that the accuracy of its entries was checkable and cross-referenceable. With so much hesitancy from the staff on using the database it was not the most accurate of records. One staff member, who was leaving, refused to update any of his projects. Projects were often marked as complete before they had made it "out the door".

Despite these problems, however, the database limped on. Even with the inaccuracies the database was still referred to and used - because there was nothing else which did its job. With a choice between no data and lousy data, the lousy data wins. Indeed, this database was not the only one with lousy data. Databases were always getting out of date with each other - replicating them (getting them to say the same) was a full time job:

R and C [the purchasing administrator] are having a discussion on why an item in Oracle had a different expire date from the date in Notes:

"Oracle and Notes... those two servers will never be in step ... the company will never be able to sack you because you keep all the databases in step. Thousands of pounds spent on big technology and C is the one who is replicating them all together"

(18/10)
It was this work which made accurate and sensible databases possible.

*Automatic signal vs. composed sign*

Another problem with the database was its role as a ‘secondary’ representation. The representation had to be manually composed after the details of jobs changed. This added extra bureaucracy to working in IS. Moreover, the database was “outside the loop”. The completion of the database was a task separate from working on IS projects, meaning that it did not become a natural part of working on the projects. The database was a secondary representation rather than a working one.

This was not inevitable. One analyst suggested the possibility of the database being a “project folder” rather than merely a reporting database:

> People don't use it but they would use it if it was more central to their work. Most of my work (e.g. bug reports etc.) come in through email. I then go and fix them. Couldn't you combine this all into the database, so that instead of emailing you the user would put a report into a database, and that would then be a task which would then get completed.

That would be a project folder, with all the interesting things about how a project was proceeding in it. So instead of having to fill in your progress elsewhere, it would come automatically from the project folder.

(QRI12)

However, when I suggested this to the manager who had designed the database he just said that he thought it was a "people problem, not a technical problem" (30/9.3). While for the analyst using the database to enter information it might have been better to have a project folder, for management the important issue was a succinct display of progress on projects. This was the explanation for the manager’s comment. He saw the problem as one of not being able to force the analysts to complete the database, rather than as a technical problem. One example of a database which was a working mechanism was the “Oracle Code Change database” discussed in chapter three.

6.3.3 Quarterly reporting as a political act

The failings of the database made it a site of conflict between staff and management. Staff resisted, but management cajoled. What seemed in the end to enforce usage was the need to look as if one was not going against management. In one discussion I overheard, an analyst explained to his manager that he would use the database if he was *told* to use the database, but he did not think he should. This conflict meant that the database was only used in a fairly perfunctory way, to keep management happy. A "reasonable" account was produced, a balance between the needs of management, and the needs of staff.
The last chapter reviewed some of the literature on the political status of formalisations (section 5.9). Some writers have seen formalisation as a tool of management, a method of "disciplining" staff, as Suchman puts it echoing Foucault. It is tempting to see the battle over the use of this quarterly reporting database as a case like this. We can then use labour process accounts of management “controlling” the workers. Accounts of the introduction and use of technology often use this rhetoric in how they describe the workplace (Kraft, 1987; Knights and Wilmott, 1988; Smith, Knights et al., 1991; Klein, 1994; Brown, 1995).

However, in the case of the quarterly reports database this battle was not as clean and simple. It is not an easy thing to take sides when one is in close contact with both sides of the argument, and can see the pressure and needs of both staff and management. Indeed, perhaps the point is that there is no simple right and wrong here, just a conflict of the different needs of different jobs. So while Suchman and other writers bemoan the lack of "structural" issues in workplace studies, perhaps their absence is due to the fact that the details of actual sites of technology use do not fit into simple structural descriptions. It was not that management dominated the staff through the use of a database. Indeed, as one manager put it to me, their power was in many ways marginal:

“Barry, you know I can’t make anyone do something - I just have to suggest and push”
(9/12)

No predefined analysis will let us decide who was right and wrong, because there was no simple right and wrong. Instead it was just different jobs with different needs. Politics in this case is something that needs to be seen in terms of the details of organisational conflict. Understanding organisational conflict comes from studying how conflicts were managed, and the strategies used by different parties to achieve their aims (Smircich and Morgan, 1982; Markus, 1983; Dent, 1991).

However, one end result of the database was that the view it presented like the timewriting system, hid the contingencies of its production. It listed, in an authorless and dispassionate account, the work of the department. All the argument over whether it should be user, or if it was a fair representation, was deleted. The quarterly reporting database achieved objectivity, appearing to rise beyond the squabbles and shortcomings of its creation.

6.4 The ethnographic account

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60 Most clearly, in the case of laboratories studies [Mackay, 1992; Russell, 1986; Winner, 1993]
Our third example takes a step away from Narajo, and asks a quite different question, but one that should be answered if we wish to be complete in our discussion of representations. For discussing computer databases as "representations" begs questions regarding this report as a "representation". If the way that databases "represent" can be explained as a "construction" can not the same be done to this report? This report is, after all, an attempt to represent the fieldwork at Narajo. Should we not ask how it represents, just as we ask questions about how the databases at Narajo represent? And if we do this, what "truth" status does this give this report?

This question is a kind of "reflexive turn" (Woolgar, 1988a). It is an attempt to look back at our own knowledge claims, and asks how it is that we can make our own claim to knowledge while disputing those of the people we study. This sort of dilemma can be shown if we apply the analysis that was done above to how this ethnography was produced.

6.4.1 The ethnographic account as a formalisation

There is a similarity between the methods used when producing this report and the work that went into producing the Notes databases at Narajo. Consider for a moment the purpose of "methods" in sociology. In a simple sense these can be seen as standardised techniques which are used to produce "knowledge". Or, at least, they are techniques which, when followed, can be appealed to "confirm" the facticity of what one is saying. An example of this is the method section in most theses, where a description of the methods followed is used as a justification for the results presented.

The importance of methods in sociology can be seen in an extract from a symposium in the 1960s, at which one of the first debates between ethnomethodologists and other sociologists took place. The sociologists persistently asked questions and made complaints about the lack of "method" in ethnomethodological accounts:

Hill: Hal [Garfinkel], you have not told us yet what rules of evidence you accept or employ.

[...]

DeFleur: What are the rules by which you unravel who is right? We have been asking for methodological information and you have been giving us subject matter.

Extract from the Purdue Symposium on Ethnomethodology (Hill and Crittenden, 1968) quoted in (pl45, Lynch, 1993)

The sociologists here were asking what justification - in the form of methods - could the ethnomethodologists provide for the 'truth' of their findings? Without methods they could not have produced truth. The assumption of the sociologists here is that if
sociology is to be a science, if it is to produce truth, then there is a need for fixed standardised methods.

Compare this with the "standardisation" of formalisations which took place in the timesheet database (see section 6.2.2). The believability of the timewriting database depended upon the timewriting process being 'standard'. Everyone has to use the same financial codes and everyone's hours need to be processed in the same way. By showing that the computer "did the same thing to everyone's numbers", it can be seen that what came out must be a reliable indicator of what staff had put on their timesheets. The mechanism of how the representation was made is used to "show" the accuracy of the representation. Putting the same numbers in again would get the same result (figure 6.6, page 179).

Compare this with the analysis for this report. The ethnographic fieldwork lasted four months. In all, that was around 1000 hours of experience, enough to produce an encyclopaedia of transcripts. Producing a research report from all this would be a near impossible task, so methods of ethnographic analysis were used to reduce the data. This process was like a chain: at each link there was less and less data, yet the account produced at the end still claimed to be authoritative and speak for "the data".

The first step in the chain was the move from the ethnographic experience to field notes. Field notes are at best a very rough account of the ethnographic experience. At the end of each day or after important meetings, I would produce on average around five A4 pages of scribbled notes. I would write down what I thought interesting, difficult or even just the first thing that came into my head. The notes wander through discussions of the food in the restaurant and ethnographic insecurity to precise details of technical problems encountered during the timesheet system's development.

Although the experience of fieldwork is 'in my memory' and not easily sharable or public, the field notes are used as the starting point because of their definite nature. It is easy to see why - field notes are text. They are malleable, sharable, public, movable and inscribed. Without the field notes I am stuck to claiming I know because I was there. With the field notes I can begin to build a defence. To help with warranting this defence I can refer to those field notes. The implicit argument here is that you can access my experience through the fieldnotes.

Powerful though these notes are, they are still a good three hundred or so pages, still too much to manage. Like the raw details of staff's working hours, they need to be coded. Coding reduced all my notes to a booklet of twenty or so pages; an index of all that happened, or what I thought important. Coding makes the notes more manageable, moving us further along the chain, condensing the complexity and
details. This is a step of "formalisation", the moving from the notes to analytic codes, reducing the data to a more manageable amount. However, since the technique is standardised there is still an arrow between "the data" and "the analysis". Anyone could have produced the same analysis from the same data. It is comparable within and between studies.

The final link is to move to the research report, to present a document that compactly speaks for the hours of ethnographic experience. To speak for the ethnography I included quotes from the fieldnotes - short extracts which we purport to be representative of the whole body. However, what if we only picked the quotes that defended out argument? What if the quotes are not a good representation? This is the appeal of techniques such as grounded theory (Glaser and Strauss, 1973): they provide standardised ways of producing an account from data. The authority of the standardised technique helps to cement our chain - making the connection between representation and the represented more believable. One can appeal to the methods as a way of showing that the analysis provided is sound. Grounded theory can help us out by the claim that our technique was “grounded in the data”. Our representation is valid, not just full of juicy quotes.

6.4.2 Irony

As the reader may have detected, there is a hint of irony in the above description. This demonstrates a problem which Woolgar has identified (Woolgar, 1983). In describing the processes by which something "becomes true" it is very difficult to produce an account that is not ironic in some way. To show how something is constructed is to inherently discredit its production. This is a problem for the research presented here because the attempt has been made to describe the construction of representations without making a judgement on their accuracy. Indeed, this is central to our discussion of the achievement of "Woolgar's arrow", that the accuracy of a database was something that was an achievement, in context. The accuracy of the database is not something that can be analysed outside the context in which the database is used, since that would be to ignore what the database was used for.

As was mentioned in the introduction to this chapter, ethnographies themselves are no longer taken for granted as a simple way of finding out the truth about a setting. Ethnography has been criticised as being linked to the empire (Said, 1989) or

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61 "Ethnography should have a characteristic 'funnel' structure, being progressively focused over its course." (p206, Hammersley and Atkinson, 1995)

62 (Lynch, 1985) is an attempt to describe what scientists do without ironicising it - and one which runs into some problems as the description eventually becomes cumbersome (Latour, 1986b).
attempting to hide an unavoidable subjectivity (Clifford, 1988). The texts of ethnography themselves have been examined, and the realist assumptions of some writers taken to task (Maanen, 1988). That is to say, ethnography has been 'deconstructed' by examining the textual practices of ethnographer, and in those descriptions either a subtle irony (or sometimes downright scepticism) creeps in.

But need a reflexive turn be threatening to truth claims:

My reading of the current turn towards text and language in ethnography is governed by a belief that holds rhetoric, broadly defined, to be the medium through which all truths or certainties are established (and shaken). Thus, for example, to look at well-received or persuasive ethnographic texts, to their compositional practices rather than through them, to the worlds they portray is to examine how a culture becomes a substantial reality for a given set of readers and perhaps beyond. By looking at representational choices and their changes over time [...] we will learn more about the art (and science) of our representational trade. (p13, Maanen, 1995)

Maanen here seems to suspend the ironicising. Rather than condemn study of ethnography he instead calls for an "ethnography of ethnography". I have been careful not to claim that the databases described above are 'wrong', just because they can be held up to some objective criteria. The databases work in the context in which they are used - that is the important issue. This sort of argument can be seen in Garfinkel's reply to the complaints of the sociologists described above:

McGinnis: What criteria would you accept as grounds for arguing that it [a conversationalists' rule for identifying persons which Sacks had just discussed] is false?
Garfinkel: Why don't you just state your objection?

(p145-6, Lynch, 1993)

McGinnis is suggesting that there is some criteria of falsification which we should use to test observations about everyday phenomena. But Garfinkel's reply takes McGinnis's question and portrays it as something that is actually a move in a "vulgar" game of academic conversation. A game in which things are accepted without "criteria". What Garfinkel is pointing out here is that there are "true" things which we all take for granted without any need for method. That, for example, there is some sort of pattern to our conversation that stops us all talking at the same time. This is a vulgar truth. But if this "everyday" notion of truth is valid for getting us through conversation, are these not the same grounds on which other claims to truth are

63 This discussion owes much to Lynch's comments on Garfinkel's remark. Whether this is actually what Garfinkel intended is another matter.
eventually made? Methods, as with notions of everyday truth, must be within the relevant competence systems to which they are bound. They do not provide a priori guarantees. As Garfinkel and Sacks put it:

"the machinery for doing accountably rational activities is available to natives, to Ethnomethodologists and to social scientists [...] We have given that some structure, and tried to exhibit both the obviousness of it, and its enormous interest and pervasiveness for members" (p358, emphasis added Garfinkel, 1970)

Simply put, the validity of this ethnography rests on the same basic representative claims of the databases at Narajo. It is based on mundane criteria of truth. Just as an attempt to show the databases at Narajo were "wrong" because they did not objectively 'represent' would make no sense, so does a similar move with this ethnography. The truth, then, of this ethnography is local to the environment in which it is produced. Just as with the database at Narajo, 'truth' is a mundane achievement64.

6.5 Summary

This chapter has attempted to show in depth how databases were used at Narajo. In doing so, the concepts of the last chapter were applied to two databases - the timewriting system, and the quarterly reporting system. These databases are formalisms in action, in that they reduce the world into the formalised terms of a computer database. Looking at this formalisation in practice reveals the activities essential to getting formalisation to work. Using even the most constrained formalisation involves a balance between the constraints and the interests of those using the formalisation.

With regard to the timesheet, a balance was achieved between producing a "reasonable account" and not spending too much time completing the timesheet. Timesheets in this database are accounts, and play a role in the interaction and communication in the workplace. As such, their readers and writers will use them with awareness of the role that they play in the work setting. Workers will want to present accounts that make sense, and that do not reflect badly on themselves. What this means to individual representations will vary, but it underlines that the entries in the database are composed by humans and not automatic accounts of reality. Although databases appear authorless, they still crucially have humans at both the reading and the writing ends.

64Garfinkel makes a similar point in (Garfinkel, 1996). However, I am unable to judge if this paper is intended to be ironic.
The key to the databases being used was that they were believed as being "good enough" representations. This involved the maintenance of "Woolgar's arrow", the connection between the representation and reality, for without the arrow a database is useless since it cannot be said to be a valid representation. Politics also had a role to play in the use of databases and their design, since control over the form of a representation is a form of political control. The design of databases can influence who has to do what work, and who gets to control who sees what. While these conflicts are political they are not easily reducible to the "right" and the "wrong", since they are conflicts between different groups with conflicting interests, disputes which are not decidable "in principle" one way or the other.

Finally, we encountered the question of reflexivity: how we can look at the construction of representations such as the databases at Narajo, without considering the status of our own account. It was suggested that just as the "truth claims" of the databases must be seen in the context of how they are used, so must the "truth claims" of this report.

This discussion is an attempt to open up the achievement of formalisation, how it is that databases come to be successfully used. Go into any organisation and you will find numerous devices like timesheets. Reports, files, records are all mundane devices for stabilising "what is going on". These devices facilitate the making sense of organisations. In the next chapter, we review the points made earlier and close this discussion by arguing that Notes was useful at Narajo because it helped people to "make sense". That is, Notes was a tool for "computer supported collaborative sensemaking"
Figure 6.1:
A paper timesheet
Jun 1996 - hours worked per day for a random sample of seven timewriters, paper based system, extracted from t/w 6, date across top

|   | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11  | 12  | 13  | 14  | 15  | 16  | 17  | 18  | 19  | 20  | 21  | 22  | 23  | 24  | 25  | 26  | 27  | 28  | 29  | 30  | 31  |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Figure 6.2
Timesheet Hours

Page 175
Timewriter completes paper form

form sent through internal mail

Approver approves form by signing it

form sent through internal mail

Finance type details of form into Oracle computer system

The paper based timesheet system

Timewriter completes electronic form, pushes "Submit" button

Email sent to approver asking them to look at form

Approver approves form by pushing button

Code - hour combinations "Broken out" into individual documents

Code-hour documents fed into Oracle system

The Notes based timesheet system

Figure 6.3
Comparison between Paper and Notes System
The working day

Details formalised into timesheet

Timesheet
Approved timesheet

Notes deletes details of days on which hours were worked

"Broken out" code - total hours worked against each code per staff member

Export to excel deletes details of individuals

Excel spreadsheet - details of Hours by code and department

Very restricted access to Oracle computer system

Oracle computer system

BACS transfers of money between organisations

Figure 6.4

As the data from the timesheet makes its way through the system, the individual details of its production are 'deleted' to make it appear more authoritative.
### Figure 6.5

The main view of the quarterly reports. Notice how the analysts name, and the slippage for his projects is displayed.
A description of a standardised technique, such as grounded theory, for going from "the data" to "the analysis" shows that the analysis would have been obtained by "anyone with the same data". The analysis is depersonalised, objective. Any dispute can be solved by demonstrating the method. This establishes the arrow between the representation and reality.

The computer calculates the totals per department

Data is fed into Oracle with all personal information removed

payments produced from Oracle

Figure 6.6

The similarities between databases and ethnographies as representations
Chapter Seven: Computer supported collaborative sensemaking

A summary of how Notes is used at work
7.1 Introduction

Back in chapter one, we posed a question: How is Notes used and how does it fit in with the work? This chapter concludes the thesis by attempting to answer this. I suggest that Notes is a machine for "collaborative sense making". Co-operating on Notes databases, staff produced an ordered view of the workplace, a 'sense' of what was going on. It was not accidental that the jobs Notes was used for made sense. These jobs were displayed as sensible because Notes presented them in an ordered and sensible manner. Staff 'made sense' of the workplace using Notes.

The last two chapters discussed how this 'making sense' was done and this is reviewed below. We start by reviewing how using Notes involves the building of a formalisation and establishing that formalisation as a representation. Like other computer databases, Notes works by formalising. What is being put into the database is divided into discrete elements, attributes are extracted which describe those elements, those elements are ordered, and so on. The database must also be believed and seen to be representative. That is, a connection must be made between the represented and the representation. This is done by showing that the database corresponds with other databases, that it seems 'reasonable', that there are checks on its validity, and so on. The first step formalises, the second creates a valid representation. With Notes established as a representation it is then consulted to make sense of the world, to establish order and organisation. The conclusion then returns to the question asked in chapter one. "Understanding use" has been the topic here, and this thesis suggests it is suitable for further study.

7.2 Getting the job done

When studying an application like Notes it is misleading to focus on the technology. Focusing on the technology has led some writers to argue that when work becomes computerised it takes place 'inside the computer', in some way becoming virtual (Reinhard, Schweitzer et al., 1994; Lloyd and Whitehead, 1996) (the 'cyber-' prefix is often used this way). This is mistaken since it ignores the fact that work, a complex ecology of tasks and activities, is something done in the 'real world'. Work does not take place inside computers any more than work takes place inside typewriters, or inside letters. Letters and typewriters are devices which are used to get the job done, but they are not the work itself. Computers, likewise, do not 'virtualise' work but instead are used as part of doing the job. These devices shape the work, but it is misleading to discuss it as 'becoming virtual'.

A different approach was followed in chapter three, where we studied actual sites of technology use. One example from this chapter was the Notes database used for
requesting changes to financial cost codes. With this database staff in the finance department could request changes to codes, have that request sent to a finance controller for approval, and then have it forwarded to the Oracle system administrator, who would then change the code on the Oracle financial computer. Notes managed the communication between the different people involved in getting the change done, while keeping a record of that communication.

This was not, however, a case of work being 'virtualised'. The code changes happened in a workplace where communication through Notes was just one part. When staff wanted a code changed quickly, or the change was likely to need some justification, they would telephone or go to see the staff concerned. They would 'nurse' the change, arguing their case with the finance controller if the change was disputed. Notes was a frame for organising the process, but the actual activity involved more than just the database. The job of getting a code changed would involve all sorts of different work, attempts to convince people that a change was correct, bothering staff to get a change done quickly, and so on. None of this activity was recorded in the database.

Notes only held a record of the electronic communications, not the verbal arguments or interactions. This made the process look orderly, secure and sensible, with none of the exceptions of individual cases. This story was the 'right story' for the staff involved, since it could be used to convince financial auditors that the process was sensible and proper. Convincing the finance auditors of this was part of the job of getting codes changed and this the computer did brilliantly. Looking at the database all one would see would be code changes neatly ordered and recorded. However, this 'ordered account' was not the process itself. That would be to confuse the computer's record with the job as it was actually done. That the process looked orderly was an accomplishment of those using the Notes system.

Notes helped in that it guided action by showing what "should" be done. If you knew nothing about how to get a code change, you could still complete the code change form and by pressing the submit button, have the form sent off to a finance controller. Notes helps to order your actions by providing the structure for what you are doing. In this sense Notes is a resource for action. It does not determine what you do next, but it gives an indication. The design of the database is a resource for understanding how to get a code changed\textsuperscript{65}. Notes is used as part of a job to produce an ordered account, and also as a resource for action.

\textsuperscript{65}Suchman describes the use of plans as "resources" in a similar way (Suchman, 1987). Norman also describes this as "knowledge in the world" as opposed to "knowledge in the head" (Norman, 1987).
7.3 Constructing the machine

Earlier in chapter two, Bittner's paper "The concept of organisation" was mentioned (section 2.2.1). This paper is a critique of the way in which the concept of "rational organisation" has been used in organisational studies. Bittner argues that this concept depends upon a common sense notion of rational behaviour. Rather than look at how the notion of rationality is actually used, analysts have relied on their own unspecified interpretations of what is and what is not rational behaviour. Rationality, Bittner argues, should be studied as a topic, rather than being used as a resource. How the concept of rationality is used in organisations should be empirically studied instead of being taken for granted. Investigating the use of Notes fits into this. Notes "produces order" in organisations by structuring routine activity and producing a rational account of that activity. That the actions of individuals using a Notes database appear rational is because of the ordered record which Notes keeps. The behaviour of staff using the database described above appears rational because Notes displays their actions as rational. It helps staff to achieve rational organisation.

7.3.1 Devices for the production of formalised, ordered accounts

In this sense, Notes is a machine for the construction of order. What could be seen as ad hoc appears standardised, ordered, structured and sensible. Moreover, it is not just activities or processes which Notes does this to: like any database program it has the ability to track just about anything. Chapter five described this, showing how Notes is used as a representation. Notes can be used to describe the world rebuilt in a standardised form. A database of people, for example, takes a collection of individuals, different from each other, and produces a similar standardised record for each person. As Focault memorably put it, this is the production of "the same in the different" (section 5.7.2).

Tracking something in a database represents it in a standardised and formalised form. This formalisation is easier to control and manage than the entities themselves. As a technique, formalisation is not unique to computers. It can be traced back to the introduction of standardised paper order forms at the beginning of the century, and the rise of "systematic management", a movement of which the more famous "scientific management" was only one part (Yates, 1989). This movement sought to turn management into a "systematic and ordered activity". Standardised forms were seen as one tool of the efficient manager since activities such as requests for equipment repair could be described in a standardised way. These forms would allow quick comparison between jobs, and the structuring of activity in the terms of the form.
Computer databases are designed to formalise phenomena in this way. They take rough, unsorted, details of the world and reproduce it in an ordered, formalised and tidy manner. All the elements in a database are arranged logically and comprehensibly, subject to rules restricting what can be recorded. It is these rules which are the building blocks of all computer databases, from massive government databases, to the Narajo timewriting system. The world is represented in this manner through the application of seven devices of database formalisation:

1. **Decomposition**

The first device decomposes the world into individual discrete entities, turning different objects into similar entities. So, for example, creating database records for people classifies them all as similar, even though they may have nothing in common.

2. **Attributing**

With what is being represented divided into entities, attributes can be allocated to each entity. Attributes are properties or descriptions of that entity. For a database of individuals each 'entity' might have a first name, a last name, a gender, and so on. Databases, by listing the same attributes for each entity create the same in the different. What was previously distinct is now becoming increasingly homogeneous as it is listed by the same attributes.

3. **Coding, classification and clustering**

With the world divided up into entities, and attributes ascribed to each of those entities, they can then be clustered into groups. This reduces the number of entities we need to concern ourselves with. People can be divided into "the men", or "the women" with no concern for any deviants outside those categories. The entities can be stereotyped by the clustered attribute, so we can talk about what men are, rather than have to concern ourselves with each individual entity. As Burrel puts it: "sameness comes to be formalised and submitted to rules as rationality becomes highly developed" (Burrell, 1988)

4. **Ordering**

Ordering allows each entity to be considered with reference to the whole. A ranking is made where each entity is positioned in order. Although a simple number, it compares each entity with every other entity. The position of each entity can be established, with "norms" discovered, and deviant attributes found.
5. **Standardisation**

The devices described above make local phenomena, situations, places, people, positions and so on, 'portable'. When something is formalised it can be viewed away from where it was produced. Unemployment, for example, is the experience of people who do not have jobs. Managing who is or isn't unemployed can be done far away from the actual sites of unemployment with a computerised record. The formalised record lets one view the details of distant or distributed sites.

To be able to rely on this record, however, needs one more device. The formalisation must be standardized. This is to ensure that with the same phenomena, the same formalisation is made. For example, what "a household" is would be standardised for a household survey, a standardised procedure would be devised for dividing a street up into individual households. This allows anyone who follows those rules to produce a similar representation. Attributes, in turn, will also be standardised - even deviant cases. In the United Kingdom, for example, transsexuals are legally classified by their sex on birth rather than their adopted gender. A standardised way of formalising gives the impression that the representation is authorless, since anyone would build the same representation of the same phenomena.

6. **Inscriptions**

So as to be portable, these formalisations need to take some physical form, be it on paper or in a computer. This is 'inscription', embedding formalisations in some medium so they can be accessed across computer networks or distributed on paper. This portability means that the formalisation can be accessed away from the sites where it is produced.

In this sense, computer databases are a "machinery of inscription", with formalised information being embodied in a computerised database. That machinery is designed so that it specifically restricts the formalisation in certain way, supporting certain operations and restricting other ("illegal") ones. Certain operations can be programmed to be completed automatically, particularly calculations. This is what makes computers particularly useful for formalisation.

7. **Re-representation, synthesising, summary and extraction**

When something is formalised into a computer database, it can be recalculated and combined with other formalisations in a variety of ways. Data can be pivoted, changed from unemployment by inflation, to inflation by unemployment. Statistics from one country can be combined with another, allowing North Europe to be compared with South, or vice versa. "Formalization enables the intertwining of
multiple rerepresentation paths. With formalization and computation, the health of the nation and the state of the public economy become addressable in the same breath." (Bowers, 1992). Data from databases can also be recontextualised. A graph can be taken from a database, and by placing it within the appropriate text it can tell the story of - say - British economic decline. Representations can be woven into texts which appear convincing and authoritative, drawing on the authority of the representation.

7.3.2 Achieving a believable account

While these devices describe how formalisation is done, they do not explain why it is that formalisms come to be accepted as representations of what they formalise. In chapter five, a comparison was drawn between how scientists attempt to establish the truth of their theories, and the way in which a Notes database is made out to be accurate. Similarities arise because in each there is an attempt to draw a connection between a description of the world, such as a scientific theory or an entry in a database, and the world itself. This was described as "achieving Woolgar's arrow", after Woolgar's discussion of how this connection is achieved. There are, of course, major differences between databases and science. Scientists are concerned with establishing the truth of their theories. For those using a computer database, however, the aim is rather more prosaic. The database is used to "get the job done", the importance is establishing the database as a "good enough" representation.

Although a Notes user has no interest in the creation of a fact in itself, but is instead concerned with 'getting the job done', both Notes users and scientists are interested in achieving the connection between the represented and the representation - Woolgar's arrow. While to scientists the arrow is an end in itself, with database users it is a means to an end. Scientists attempt to replace indexical, local phenomena with objective global descriptions. A Notes database is instead an indexical representation used for some purpose. Its meaning is something which is decided in situ, and for the purposes to which it is put.

For Notes databases to be used successfully, it is important that they are established as a "good enough" account for the matter at hand. This cannot simply be settled by referring to what is being represented because what is being represented is physically distant, or not simply observable. What makes a database work, then, is that it is believed to be valid. How this is done is not with a check with reality, but involves a number of further devices to achieve Woolgar's arrow. Databases exploit common devices which establish their accuracy, and chapter five listed five different ways that this is done:
1. **Tallying with other representations**

A database must *tally with other representations* of the same or overlapping phenomena. In simple cases, these other representations could be verbal accounts or first hand observations. A stock control system must appear to tally with what is on the shelves, at least most of the time, for it to be believable. In complex cases, chains of representations exist with subsequent representations making use of previous representations. These webs can be checked to confirm and ratify information held in other representations. So the timesheet database might be compared with the salary database, which is in turn compared with the total wages bill, and so on.

2. **Reasonable account**

A database must be *reasonable* in that what it says must seem potentially possible. If a purchasing database claims, for example, that a busy company had not purchased anything in the last three months, this would seem unreasonable. What is reasonable changes from database to database, but the maintenance of "reasonableness" is vital to a database being believed.

3. **Visible updating**

A database must be *seen to be updated*. When what is being represented is likely to change, then the database tracking it must also been seen to change, otherwise the representation will loose credibility. Yearly statistics, for example, appear increasingly ‘inaccurate’ as the year progresses. Making the updating publicly visible can also help to establish the credibility of a representation.

4. **The view from nowhere**

Credibility is also crucially linked to how the representation is presented. One important device is the ability for databases to appear *authorless*. They typify the "view from nowhere", in that their authorship is deleted. This makes the information included in them appear more objective and accurate, detached from the situation of its production, and any particular individual’s viewpoint. A computer database deletes the author to the extent that it is the *computer* that appears to be the author. Records are calculated and updated *by the computer*. Of course, the computer is constructed by a human, and the data entered by individuals, but this is hidden in the form in which the database presents its information.

5. **Appeal to procedure**

If the workings of a database can be explained, then reliability can be asserted be referring to the workings. If the database is updated in a regular, reliable manner then
it follows that the contents of the database must be reliable too. This is the appeal of computerised controls and calculation - they emphasise the standardised nature of the computer database. The more the workings are computerised the better, since they are 'automatic', and not open to the criticism of human error. Controls also play a role, since controls can enforce the regularity of the data. Highlighting these controls emphasises the reliability of the representation.

7.4 Day to day use of a Notes database

Since Notes is used to help 'get the job done', how it is used is tied in with what does, and what does not, advance that aim. A Notes database is not updated to be some super-accurate, objective account of the world. Instead, it is kept as accurate as the job demands. A simple example of this is how fields in Notes databases are often left blank. If filling in that information was not likely to help getting the job done, there was no reason to waste time filling in the blank. The aim is, after all, to use the representation, not to create a literal representation. Accordingly, Notes fields are not completed according to objective rules of "what the field should be". Instead, the concern is with what will make sense to the likely reader. So text fields may be subverted to add comments, even though this might not strictly fit in with the field's definition.

Bittner and Garfinkel's paper "Good organisational reasons for bad clinical records" (Bittner and Garfinkel, 1967) highlights the same practices in the use of clinical records. They show that medical records are kept as "records of a therapeutic contract" rather than as "actuarial records". The concern is not with some objective notion of accuracy, but with recording information so as to be able to inform others of the medical state of the client. Moreover, the records must display the clinical process as sensible, and professional for legal purposes. They call this a "reasonable account for medico-legal purposes", an account which demonstrates good practice (to prevent legal problems) while still informing others of the medical state of the patient.

The timesheet system discussed in chapter six was similar, in that it was not used to produce a literal, "actuarial", account of time worked. Instead the aim was to produce a "reasonable, sensible, believable" account. This involved concerns such as "does this timesheet look sensible and believable?", "does it present a reasonable, professional, sensible way of employing my time?", "how little time can I spend on completing this timesheet, without producing an incompetent report?" Since staff knew the intended purpose of the timesheet reports, they designed their accounts with this purpose in mind. They saw no need to produce a perfectly accurate account since this would have taken time which could have been usefully spent doing other tasks.
At times this can cause conflicts with the way that databases are designed. One of the most common constraints in databases is that of the 'type' of fields. Fields in records are often constrained to hold just one 'type' of information. So a currency field, for example, will only be capable of holding a number. If one takes an actuarial stance on how databases are used, this makes sense. Currency, for example, can only be a number. However, this is to ignore the way data is input with an eye to how it will be read. It is not used as an objective production, but as document which is produced to make sense to the reader. So the currency value might have a '?' after it to indicate doubt. It might have a short message to say it is "to be confirmed". The value is not something which is an objective "number", but something intended is to make sense in the context of its use.

7.4.1 Control, accounts and politics

Another aspect of databases in use is that those who design and use the database will not necessarily have the same intentions. The writers, readers and designers may all have different needs. Databases are often political objects, attempts to force others to act in a certain way. In chapter six we discussed this political aspect and how it can manifest itself in two ways, as an enforced division of labour and as control through reporting.

The timesheet system was an example of an attempt to enforce a division of labour. With the paper timesheet, staff could write time to finance codes which were no longer valid, or even just write descriptions and leave the finding of codes to the finance department. Perhaps understandably, the finance department were not happy about this, since chasing up finance code took up most of the time spend administering the paper timesheets. To prevent this the Notes system forced timesheets to have a valid financial codes for every hour worked, checking these codes against a centralised list.

A second method of controlling staff using a database was by using Notes as a form of monitoring and reporting. Notes can be used this way to display a publicly available account of the work done, "opening up" what was previously private. This can cause all sorts of problems about how the account is formed, and who controls the design of the account. At Narajo, IS staff were particularly unhappy about the need to complete details in a "quarterly report database", a list of IS projects and how long they were behind schedule. The database had been designed in such a way that staff were unable to explain in the database why projects had been slipped, merely that they had slipped. Staff resorted to 'hacking' the description field to add an explanation of why a given project had fallen behind. Even more involved disputes arose over "the change management system" (discussed in chapter three), a database intended to
record change done by the IS staff. This caused conflict, since it restricted the ability of staff to control their own work and made the details of their work publicly accountable - and measurable - by management.

7.5 Computer support for collaborative sensemaking

After this review, these observations can be brought to a conclusion. The aim of this thesis has been to answer the question posed in the first chapter, "what does Notes do?". This chapter has covered a number of answers to this, answers which can be summarised by saying that Notes is a device for collaborative sense making.

Notes helped staff to collaborate on shared representations. These representations offered an avenue for presenting an ordered, sensible view of what was going on at Narajo. "Making sense" of what was going on at Narajo was not a private cognitive activity, but something which was done by co-operative, public work on Notes databases66. It was through the design and updating of databases that an ordered account of Narajo came to be produced. That account in turn becomes a way of understanding what is being represented. Using the database is "making sense", in that "the sense" was actively produced by the staff co-operating on databases.

Earlier it was described how Notes was used to produce "organisation". A Notes database allows staff to produce an ordered account of their activities. Understanding what is going on then becomes easy - just look at the database. It is no accident that the view the database presents is of ordered, sensible activity. Making sense of something is a familiar activity. We do it every day when we try and understand someone's actions, or understand why something is the way it is. This use of the phrase plays with this notion slightly, since rather than "making sense" being something which is done by an individual, 'inside their head' as it were, making sense with Notes is a collaborative activity done "in the world". Using reports, documents, Lotus Notes and so on, accounts of the world are worked up so as to produce a sensible account. It is this activity which can be called "making sense", the production of sense.

Making sense in these terms is an inherently social activity, rather than one which can be described in cognitive terms. It is through the public display of work in the Notes database that the work comes to "make sense". Moreover, the activities which make the database possible are distributed amongst different staff members. Individuals contribute different information to the database, adding to the whole representation.

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66 Weick, for example, falls into a trap of seeing sensemaking as a psychological phenomenon. (Weick, 1995)
Staff can design Notes databases which formalise what is in the world, and collaboratively use that formalisation to make sense of their activities, both to themselves and others. Notes was therefore used as a collaborative sensemaking tool.

7.6 Generalising from Narajo

Because of the nature of this study, the data used here comes from a very limited sample. The main source is just one company – Narajo Oil. By its very nature, ethnography limits the number of organisations which can be studied. Since different companies are likely to use Notes in different ways, this could be taken to mean that these observations are not generalisable. This would be a mistake. While it is true that the results here cannot be generalised in the same way that statistics can, this is not to say they are not generalisable at all. The story in this thesis is of "what is possible". At Narajo, Notes was used successfully, and in ways which are interesting enough that they suggest how technology can be used elsewhere. A story need not be identical to some other situation for it to be valuable. Rather it is that in the details of how something happened that we may learn lessons to help us elsewhere.

So the implication of this thesis is not that all organisations which use Notes are like Narajo, or even that the majority are. Rather, it is that Notes can be used this way, and that how it was used at Narajo is interesting in itself. That Notes can be used for ordering organisations in this way gives us a new way of thinking about how technology is used, and how it integrates into the work. As a story of technology in use it is, to return to the questions posed in chapter one, an answer to "what?" rather than "why?" questions.

While it is unlikely that Lotus Notes will be around in twenty years time, the activities it helps to support – loosely called co-operation - are a permanent feature of modern organisations. The first finding of this thesis, that Notes was useful to the companies studied here, and that it did help staff to work together suggests that how it did this is an important issue. For as technology is increasingly applied to help staff "work together", the features which Notes supports today are likely to make an appearance in future computer systems. The second finding of this thesis has been just how this technology can support co-operation in practice. So while the successors to Notes will take different names ("corporate intranets", "value-nets", the "virtual organisation"), if they are to be as useful they should support the activities discovered here. Computer support for collaborative sensemaking, the joint working up of organised representations which help to co-ordinate and make sense of the working world, is an important part of getting computers to assist collaboration.
7.7 The value of studying use

Along with describing Notes in use, this study indirectly makes a second point. It is that the use of technology is a topic worthy of study in itself, without reference to design. The simplest use of a technology has a story to tell, since 'the manual' does not determine use. It is a story waiting to be told.

In-depth study, such as that conducted for this thesis, allows technology use to be described in far more detail than the accounts conventionally presented in the literature. Issues such as communication with computers are still to a large extent described in the terms of restrictive formalised models. Rationalistic models are limited in that they fail to predict or explain the vast majority of human behaviour. More worryingly, there is seldom any discussion of the work environment of which technology is a part. The discussion of technology use in this thesis is an attempt to move beyond these limitations. By looking at the details of how technology was used in situ, we obtain an account which while less formal, describes some of the detail of actual use. Studying use takes an approach which starts from practice, rather than from formalised models.

In a study such as this it is also the actual concerns of those using the technology that are addressed. Since this study was based on working with those involved in using Notes, the concerns which are voiced here are those of staff at the "chip face". Rather than addressing concerns which originate from lab experiments, actual problems encountered in the day to day use are highlighted. Two examples from this thesis demonstrate this. When discussing the work of programmers in chapter three, it was shown that during development the concern is with the closing of design discussions, of achieving agreement on what needs to be implemented. Yet discussions of programming in the literature have focused on ever more complex methods to extract requirements. This "opens up" questions of design - providing more information on needs or including more participants. What was identified as a problem for developers, however, was the opposite of this - the need to close design decisions, and enforce some sort of agreement. Another example of this is the political aspects of technology. The dispute which arose over how the quarterly reports database was designed (section 6.3) was a political dispute over who controlled the account of work which went to higher management. Again, in software engineering these questions have been generally ignored.

Unlike some studies which take a look at technology, there is no "implications for design" chapter here. This is not to say that these observations have no input into design. For example, chapter three discusses how spreadsheets were used to help create lists and to help manage the presentation of work. This highlights an activity
which currently has no explicit computer support, the endogenous ad hoc ordering of information in the workplace, a possible avenue for design. However, this sort of work - designing new computer systems - is separate from the study of technology in use. While the study of technology use can indeed inform design, it is an endeavour which is worthwhile for its own purposes, regardless of what it says about design.

The aim of the thesis has been to uncover a story about how technology is used. Until recently these stories of the actual work staff do to get technology to work have been ignored. The staff at Narajo skilfully integrated, changed, and appropriated Notes to fit what they wanted to do. At times this caused conflict, but staff managed at all times to 'get the job done'. Studying this achievement reveals something of the nature of work and how this is intertwined with modern technology.
Bibliography


Aussems, G. J. A. (1994) Workflow automation in four administrative organisations, Masters thesis, Department of computer science, University of Twente, Enschede.


I. (eds) Transforming organisations with information technology. North-Holand, Elsevier science B.V.


Editorial (1997) 'You can't follow the science wars without a battle map', *The economist* 13th December.


Greenbaum, J. (1988) 'In search of cooperation: A historical analysis of work organization and management strategies', in *CSCW-88: proceedings of the conference on computer-supported co-operative work*. 

Page 200


Hill, R. J. and Crittenden, K. S. (1968) *Proceedings of the purdue symposium on ethnomethodology*, Institute for the study of social change, Department of sociology, Purdue university, Purdue, IN.


Latour, B. (1986b) 'Will the last person to leave the social studies of science please turn on the tape recorder?', *Social studies of science*, 16: 541-48.


Loperfido, A. M. (1993) 'Electronic mail as a media choice for managers', *Electronic journal of communication/La revue electronique de communication*, 3(2).


Potts, C. (1993) 'Software engineering research revisited', *IEEE Software*


Roberts, B. (1996) 'Groupware strategies: six key technologies will tell you if you need notes or the web or notes and the web', *Byte* July 1996, 68-72.

Robinson, M. (1993a) 'As real as it gets.. taming models and reconstructing procedures', in *Proceedings of the workshop on social science research, technical systems and co-operative work*. Paris, France.


Sommerville, I., Rodden, T., Sawyer, P. and Bentley, R. (1992) 'Sociologists can be suprisingly useful in interactive systems design', unpublished paper.


Suchman, L. (1983) 'Office procedures as as practical action: models of work and system design', *ACM transactions on office information systems* 1, 14: 320-328.


Suchman, L. and Jordan, B. (1988) 'Computerization and women's knowledge', in *IFIP conference on women, work and computerization, Amsterdam*.


