Designing for Mobility, Collaboration and Information use by Blue-Collar Workers

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Jacqueline Brodie and Mark Perry
DISC, Brunel University

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INTRODUCTION

The uptake of mobile phones in the UK has increased exponentially in the past two years, indicating that a wider range of users are now utilising mobile technologies in different contexts than ever before. Still little is known about how mobile technologies are used amongst different populations in specific contexts and this research addresses the context of work use by blue-collar workers with an aim to augmenting this with new mobile technologies better suited to their informational and communicative needs.

Most of the current public domain research into mobile device use practice concentrates primarily on professional workers (the ubiquitous 'mobile professional') and 'knowledge workers' (e.g. Bellotti and Bly, 1996; O'Hara *et al*. 2001). It seeks to discover how mobile technology, particularly Personal Digital Assistants (PDA's) and 'communicators', can be designed to help mobile professionals retain a sense of awareness of their workplace and work colleagues while they are away from their traditional workplaces. To a lesser extent, 'teens' (Ling, 2000) using SMS/ text messaging and novice users (e.g. Palen, 2000) are also examined, but there is very little understanding of the nature of other, and equally as important (in terms of the numbers of users and their importance to the economy), less well represented user groups.

BACKGROUND TO THE AREA

Specific research – and its concomitant development work - into the informational and communicative needs of mobile blue-collar workers (either semi-skilled or non-professional workers) is strange in its absence. Perhaps this research is not seen as 'sexy', or that these users are the commercially important 'early adopters' – whatever the case, little has been done to redress the issue. This is a worrying trend in the design of technology – not only is it in a sense discriminatory (in that increasingly technological power is invested in the hands of managers, and not the workers), but also because it is ignoring a potentially large market. In the UK, it would be rare to find a self-employed blue-collar worker who did not use a mobile telephone for work. However, the kinds of other mobile technologies available to this cohort are extremely limited, as most of the current technologies are very much to do with building contact lists, diaries and other forms of documents used in knowledge work.

This lack of interest in blue-collar worker research is despite the lessons learned in Orr's study (1996) into mobile photocopy repair technicians, where he identified that the shared "war stories" of these technicians had a critical role to play in supporting their daily work practices. This lead to his recommendation that members of this 'community of practice' (Wenger, 1998) should be given radio equipment to enable them to remain in contact throughout the day to support each other in their repair tasks. Likewise, Luff and Heath's (1998) research looking at another mobile blue-collar community of practice, London underground station staff, identified the need for suitable mobile technology that could support their collaboration with other communities of practice such as the police when a suspect package is found in the station or with engineers and maintenance staff when they need to discuss possible solutions to technical problems that have occurred.

Work at the Viktoria Institute has been of interest in this area too, as they have looked at more non-traditional areas of mobile technology use (e.g. repairmen), with the intention of supporting this with mobile technology (Kristoffersen and Ljungberg, 1999). However, their research has focussed largely on the issues of the interface, rather than on the aspects of use in the work itself. Other technology developers, such as Symbol (www.symbol.com) have developed hardware solutions for the more rugged, industrial settings and in-vehicle logistical and navigational systems, whilst Psion (www.psion.com) have developed technologies for use in warehousing and transportation settings. However, these are largely process-based technologies and users have had little opportunity (or encouragement) to use them as co-operative or collaborative systems.

The blue-collar research we are carrying out at Brunel will benefit the developers of mobile computing and mobile telephony by providing them with an understanding of a significant, but largely invisible group of their users, their informational requirements, and potential avenues for the development of next generation devices to support them. This population of blue collar workers has so far also been opaque to network service providers, as their business uses are often hidden by service contracts that classify them as 'consumers' rather than 'business users' in customer databases. This is an increasing problem for phone networks, as the form of 'pay-as-you-go' telephone contracts do not even allow them to identify the name of the phone owner, let alone their profession.

FINDINGS FROM A PRELIMINARY STUDY

We carried out a preliminary study into collaboration and information use in mobile work focussing on the communicative behaviour of five mobile business people. This research was carried out between November 2000 and February 2001 and involved a one and a half-hour contextual interview following a business trip taken by each of our participants. The key findings of our research were as follows:

- Mobile collaboration[1] is hard and more difficult to achieve than traditional remote collaboration in CSCW/groupware because of the organisational, social, cultural,

[1] We differentiate between two forms of action here; by *collaboration* we mean working on a shared task-based goal, whilst *co-ordination* involves a simpler form of information recall or articulation work (most usually agreeing where to meet, or breaking a task into parts).

cognitive and technical challenges of being mobile. We found business people tended to rely on the use of the mobile telephone to co-ordinate face-to-face meetings and document exchanges to complete their work activities when mobile. Achieving even this was difficult - as phone calls to other static or mobile colleagues often led to several rounds of fruitless voice mail messages before people were able to communication with each other synchronously.

- There is the expectancy of immediacy - of 'anytime, anywhere' access to email, voice mail and other information sent by colleagues and clients despite the fact that mobile devices are seldom able to live up to this promise. This can cause anxiety and frustration on both the receiving and sending sides of electronic communications.

- Despite an expressed desire by most of those interviewed to retain the boundaries between work and home-life there appeared a heavy spill over of work activities into home-life for mobile workers. This lead to discussions about what one of our participants termed "chalk-lining": where 'lines' are drawn around activities to distinguish them as work or home activities regardless of location or time of day (e.g. writing business emails on the trains at night or phoning friends in the car when travelling to and from business locations during the day).

After documenting in our preliminary research a whole host of problems that dog mobile white-collar 'communities of knowledge', we decided to turn our attention, in our full study, to look at mobile blue-collar 'communities of practice'. This is because if white-collar workers, with their wide array of technological resources to draw on find it hard to collaborate with their colleagues when mobile, what hope for successful collaboration could exist for blue-collar workers in their resource impoverished environments?

MOBILE 'WORKSPACES' AND EMERGENT 'WORKPLACES' FOR BLUE-COLLAR WORKERS

It has been pointed out that we cannot create a sense of 'place' through technology but only a sense of 'space'. Place is "socially constructed" through "social meaning, conventions and cultural understandings" etc. (Harrison and Dourish, 1996:69), and it seems clear that mobile technologies can be designed and used to provide a space for 'communities of practice. These virtual communities of practice would allow groups such as mobile blue-collar workers (of various kinds) to create their own sense of 'workplace' and to facilitate their opportunities to communicate, co-ordinate and ultimately collaborate no matter what they may be doing or wherever they may be.

Unfortunately, from the point of view of user-centred design, this neglect of research into how mobile blue-collar workers operate, the problems they face, and the strategies and techniques that they use to co-ordinate/ collaborate with mobile or static colleagues is a problem. Without this, how can designers and developers envision and create future mobile technology that will successfully support the dynamic, flexible and often urgent nature of the work that mobile blue-collar workers do? Fieldwork is desperately needed to ensure that the demanding nature of mobile blue-collar work is fully documented, and the physical constraints that any mobile blue-collar device will

function under are examined. Attempts to design technologies that aim to support the communicative and collaborative activities of mobile blue-collar workers are likely to fail without this. Our research as outlined below seeks to address this deficit.

TECHNOLOGY LANDSCAPE

This work is happening against a changing technological landscape – the much hyped (and questionably valued) GPRS and 3G services are appearing closer to deployment, and Bluetooth and location-based technologies are nearing the marketplace. These will allow the always on, always visible, device connectivity technologies that may provide the basis for allowing the generation of a distributed and mobile community of practice. We are already examining how some of these could be applied in the design of technology with networked mobile handheld devices (iPaq), using high bandwidth, radio technology (WLAN). Over the next year we will be using these studies to design and evaluate prototype applications to support these user communities, and the results will feed into the next stage of mobile device design.

RESEARCH AND DATA COLLECTION

Following on from our recent research at Brunel University (supported by the EPSRC and Symbian Ltd.) into the 'capture and communicate' activities of business people when they are mobile, our blue-collar research will draw on ethnographic and contextually grounded fieldwork techniques. It is intended to investigate the use of mobile voice and data connectivity in the real world settings of mobile blue-collar workers. This seeks to uncover not only the nature of blue-collar work, but also how mobile technology is integrated into the lives of blue-collar workers at present and what kinds of activities future technology could and should be supporting.

Our research entails the investigation of the mobile work activities of 15 blue-collar workers. Five blue-collar workers are being studied in-depth by detailing the activities they undertake in their everyday work as they are shadowed over a day using an ethnographically informed fieldwork approach (Agar, 1980). This is complemented through the use of unstructured contextual interviews (Beyer & Holtzblatt 1997; Väänänen-Vainio-Mattila and Ruuska 1998) for a further ten participants, who face questions regarding their use of artefacts, generated or collected in their work, to allow them to meet their informative, collaborative and communicative needs. Data collection and analysis will take place over the summer period and we will be in a position to discuss our findings at the workshop.

ONGOING WORK (DATA COLLECTION AND ANALYSIS)

As of 1st August 2001, interviews are ongoing. We have conducted 9 interviews so far with a range of blue collar workers, including (1) a telecommunications engineer, (2) one of several brothers in family run firm of domestic gas installers, (3) a fax, printer, photocopy repair engineer, (4) an electric meter installer in homes and offices, (5), an electrician (6) a mobile hairdresser, (7) a mobile cleaner, (8) a brick layer and (9) a painter/decorator. All were highly mobile, working in a range of different sizes of organisations. We have so far only had time to conduct a preliminary analysis of some

of these, but the findings are interesting and early indications are that the participants' activities and needs appear very different to previous work on mobile professionals.

Preliminary findings

In general, the people interviewed were all heavy mobile phone users. One of the participants recalled an occasion where she did not answer the phone and missed around 125 calls over the course of the day. Despite this use of telephone technology, many of them (although not all) were extremely resistant to using other forms of technology. Indeed, there was a great deal of diversity in the technological skills and task-based technical abilities of the participants. Whilst there were large differences between the interviewees, there were also a number of interesting similarities in aspects of the work. These similarities tended to revolve around their resolution of issues around independence and interdependence, their reliance on physical work and communication of information about what was and its *physical performance* (unlike knowledge work) and, perhaps most noticeably, the culture of working class, manual work.

1. The mobile phone helps shape and support the way the job is done.

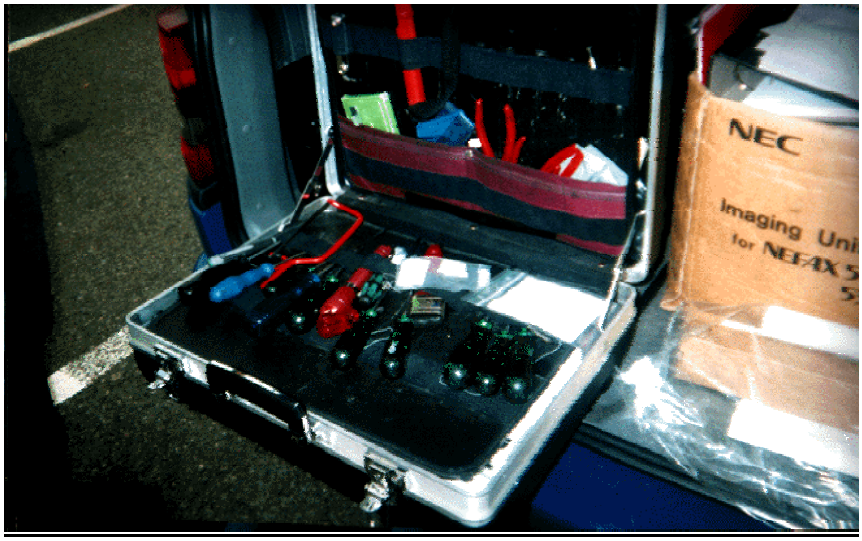
No doubt none of our blue collar workers could do the jobs they do - the way they do them now - without a mobile phone. The gas appliance installer said firm would not have been able to have grown as big without the mobile phone to handle the logistics of the day-to-day running of the business, as well as the ability to be able to be contacted at a moment's notice by residency associations for urgent jobs when gas is smelt in a house. All our blue-collar workers used the phone to primarily co-ordinate their activities with control rooms, their co-workers, their customers and their families/friends. Accountability plays a part too, as our telecommunications engineer normally only gets 2 calls from her boss in the day - but the day that she decided not to answer her phone, she received 10 calls from him. Likewise, our photocopy repair engineer always needs to inform someone when has finished a job, even when the callout centre is closed for the evening.

In the small family business, the gas engineers would tend to phone each other up directly, bypassing the shop manager, as he may well be busy selling domestic appliances to customers and unable to answer the phone immediately. In larger businesses they would be expected to go through the control room when trying to locate a colleague - although in practice, this was not always the case. Indeed, when the photocopy repairman had previously worked for Rank Xerox he had "instant messenger" on his laptop and he could freely talk (text-based) to his colleagues when on a job, which he found extremely useful for knowledge discovery. The telecommunications engineer would often use SMS text messages to arrange lunch with colleagues or meet up to provide assistance on a job.

2. Capture and communication of information throughout the day

In our small sample so far, our blue-collar workers need to capture and communicate a great deal of information during the day - although the bulk of information dealt with is "capture" type information. This information comes from central control rooms, their line managers, customers and other departments and communities that

they work with. Much of it is numerical in nature e.g. job number; serial number of equipment being used; model number; and phone numbers. At other times they need to access quite detailed and technical information, from manuals, blue prints, plans and estimates from jobs; as well as looking at log books and seeing what kinds of repair work, and by whom, has been done on a machine. The kinds of information that is carried around and needed by the participants is illustrated in the photograph of the photocopier repairman's car below:



The photocopier repairman has to carry his toolbox everywhere with him. Next to his briefcase is his box of manuals, which he needs when tackling a machine he is not familiar with.

Some easy way to record the information they capture would be helpful to them, e.g. our telecommunications engineer thought that a recording memo facility on her phone would be useful where once given a job number she could speak it into the phone so she could store this quickly (and without having to interact and access a more complex device manually). The photocopy repairman and I discussed the possibility in the future of a camera in a phone so the person he is talking to can see what he has done so far and also watch as he tries their suggestions to fix the device. Awareness of other people on their team would also be helpful. There was no point phoning someone in your team if you are trying to deal with something urgently and their phone is already engaged or switched off. Some kind of "buddy awareness system" through the phone would be useful for our workers.

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3. The Social Role of the phone is evident among our blue collar users

The gas installer engineer told me that his son recently was buying a house and would not have been able to have dealt with the transaction and still be at his work, as an apprentice installer, unless he had had a mobile phone to communicate with his solicitors when he needed to. The telecommunications engineer and her step-daughters use text throughout the day - ensuring they retain their bond - and the photocopy engineer will phone his wife several times a day to let her know his whereabouts and when he will be able to pick her up from work at the end of the working day.

An second interesting social aspect of telephone use was the use of the telephone by colleagues (as a user proxy), and particularly by apprentices: we heard about occasions when a more experienced apprentice would take phone messages for the participants (and fill in forms also) whilst their trainer was busy. Apprentices often phoned the customer help-lines (of appliances that were being fixed) to get information if there were problems, while the participants continued to work – this was because the customer help-lines could take up to an hour of waiting on hold and being passed from one person to another. The participants also reported apprentices answering the telephone for them whilst driving between sites and asking their head offices for directions or instructions.

RESEARCH QUESTIONS ARISING

Below is a list of issues that we seek to find answers to from our ongoing research:

- Does co-ordination/ collaboration exist among blue-collar workers when mobile at present and if not why not? Is it the nature of the work that prohibits collaboration, the nature of the technology or a relationship between the two?

- Our recent research into mobile professionals identified a slackening off of the traditionally boundaries between home life and work life of our mobile white collar workers. Is this merging of home life and work life also present in the lives of mobile blue-collar workers? For example, when the laptop is switched "on" mobile workers often consider themselves to be working, no matter their location. Do blue-collar workers feel the same if their work mobile phones are on, or do they only feel they are working when the tools of their profession are in their hands and their work clothes are on?

- Is there a price to pay for awareness? How 'open' are our blue-collar workers to allowing others an awareness of their daily activities? What kind of activities would they allow/want others to be made aware of and who would those others be?

- How well does existing technology and the non-technological artefacts used by mobile blue collar workers allow them to co-ordinate/collaborate their activities with each other and those others outside their communities of practice such as suppliers of materials, their families and friends.

- What are the special requirements that being both mobile and working in a hands-on job, such as building, mean for the design of technological devices in the future if they are to provide a suitable workspace to facilitate the creation or maintenance of a sense of shared workplace?

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