'Smart Mobs' and Technology Probes: Evaluating Texting at Work

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1. ABSTRACT

This paper considers methods for evaluating the use of texting as a means of enabling people to send messages to displays *situated in the fabric* of a setting and discusses the findings from 'technology probes' - a logging system embedded in the technology - as a device for understanding technology in use.

2. KEYWORDS SMS; technology probes; situated displays; ethnography

3. INTRODUCTION: INVESTIGATING TEXTING

In 'Smart Mobs' Howard Rheingold (2002) makes some dramatic claims about the social and political impact of texting, drawing particular attention to the emergence of 'thumb tribes' and 'generation txt' and the potential impact of texting on practices as diverse as teenage mating rituals and demonstrations. Like Rheingold we are equally interested in one of the most surprising phenomena to have occurred within the field of mobile computing within recent years - the uptake of SMS (or Short Message Service) text messaging. Unlike Rheingold we are reluctant to speculate wildly on what exactly this development might amount to or mean – instead our interest is in carefully *evaluating* the developing use of a novel technology. Our studies are particularly concerned to understand a use of SMS texting that has received little investigation to date - the use of texting as a means of enabling people to send messages to displays *situated in the fabric* of a setting rather than to another mobile device owned by a particular individual. Such a facility has clear potential in cooperative work settings where the need to distribute awareness amongst members means that messaging to a place may be more appropriate than messaging directly to a particular individual. The potential utility of 'situated displays' is articulated by O'Hara et al. (2002):

> *In recent years, more and more information is being presented on dedicated digital displays situated at particular locations within our environment. At their most basic, digital display technologies allow information to be more easily updated dynamically and remotely. However, these new kinds of interaction technologies also allow people to use these situated displays in novel ways both as for the individual's purposes and in the* ***support of group work****.* (our emphasis)

O'Hara et al. draw particular attention to the potential for texting to and updating situated displays remotely, and it is this functionality and how we might evaluate – or *measure* and *assess* – its peculiarities in situ, that forms the focus of this paper. Although it is tempting to regard the challenges presented by situated displays as similar to those posed by less novel display systems, O'Hara et al. (2003) state otherwise:

> *Situated displays cannot be simply regarded within the same interaction paradigm as displayed-based interaction at the desktop. While there are undoubtedly some common principles, there are also many unique characteristics of situated displays that present us with particular design considerations and challenges. There are also many unique affordances of these display technologies that can have an important impact in the way that they shape both individual and social behaviour.*

Although O'Hara et al. (2003) were addressing the *design* of situated displays we believe that there are similar difficulties associated with the *evaluation* of such technology, a difficulty increased since classic questions about exactly *when* and *how* evaluation should be carried out arise in pertinent forms. Thus there is a need to explore and trial methods for understanding the use of situated displays in general and as a means of distributing awareness in particular.

This is not just about long-standing disputes about quantitative versus qualitative methods, though here are, of course, various well-known problems involved in interpreting statistical data along with associated issues concerning what data is appropriate and how it might be collected. Nor is this solely about volatile nature of artefacts in situ and how envisaged and actual use sometimes conflict and contradict. At the heart of this dispute is an argument about what an evaluation might look like and what and whom it is for. To some extent we wish to sidestep this issue and, to this end, in this paper we primarily outline and consider some of the technical and human *difficulties* involved in data collection and evaluation.

4. TEXTING TECHNOLOGIES: SPAM

In this paper we describe a SPAM (SMS Public Asynchronous Messenger) machine deployed in a residential care setting that enables users – care workers – to text to and update situated displays remotely in order to facilitate coordination and cooperation with remote work colleagues. In texting to situated displays users of the SPAM system may make available to others their location, plans, and activities, and thereby draw upon and reflect social aspects of everyday life that are essential to collaboration and coordination. Another way of thinking about the SPAM technology is in terms of 'affordances' (Anderson and Sharrock 1993). Here our interest is in how the different features of the assembled systems are constructed so as to 'afford knowledge', for example, of the working division of labour through the reflexive articulation of the ways in which the various workaday activities in a setting are coordinated and performed. Accordingly, texts (to SPAM) become both the focus of work and a visible record of work that has been done, put on hold, remains to be done, and so on. By embedding messages in the fabric of the workplace, by *putting the work on display* so that *others may be aware of it*, these textual representations make everyday work 'visible' so that it can be 'taken note of', 'reviewed', 'queried' and in other ways be made accountable by and for others involved in the work. Thus SPAM affords 'social translucence' (Kellogg et al. 2000) and in doing so the *positioning* of the display is critical. Placement can vastly affect how *indexical* the texts displayed are to the activities surrounding them and therefore how intelligible they are to those distanced from those activities' peculiarities.

The SPAM system has been developed to support cooperation between staff working at two associated sites located in a small city in the North of England. The requirements for SPAM were obtained through ethnographic study, informational probes (Cheverst et al. 2003b) and design workshops. The overall response to the idea of a messaging system was extremely positive, being viewed as another, alternative, tool for communication capable of supporting staff in their everyday work. This, then, became the rationale for the construction, testing and deployment of the SPAM system.

Figure 1. One of the SPAM Displays

The SPAM system has been designed to run an SMS messaging application, allowing staff in the two sites to communicate easily by composing messages using an on screen keyboard displayed on a touch sensitive screen (Figure 1). The SPAM units were placed in a public location in both offices, such that the displays were highly visible. When messages are received by a SPAM unit they are displayed on the screen until deleted by a member of staff. Staff can also use their own mobile phones in order to send text messages to the SPAM displays when they are out of the office and to receive messages originating from a SPAM display.

The overall design of the system architecture is shown in Figure 2. This figure shows how all messages are routed through two SPAM units, making logging of text exchanges possible. This figure also highlights the way in which SMS messages sent via mobile phones and by the SPAM units themselves are handled by the system.

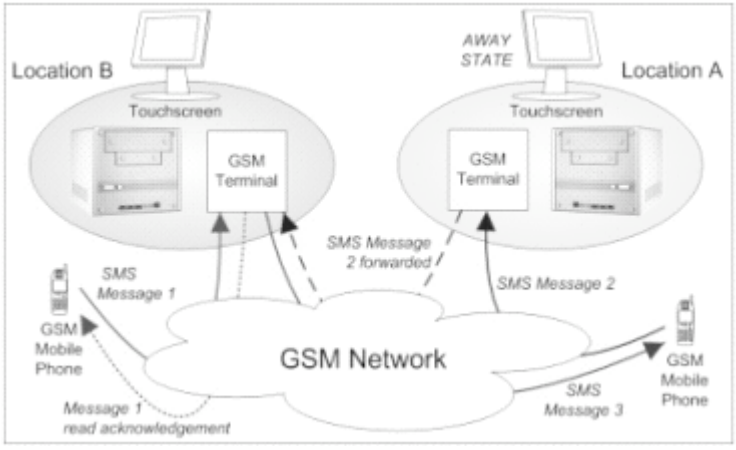

Figure 2. Architecture of the SPAM system

The typical use scenario is illustrated by SMS Message 1 - i.e., the message originating from a mobile phone is successfully delivered to the permanently staffed hostel (Location B) and the transmission of a 'message read' acknowledgement is triggered by a member of staff reading the message. Message forwarding is performed by the system if a message is sent to the semi-independent living accommodation (Location A) at a time when no member of staff is

providing cover (denoted by AWAY STATE). In this case, the message (Message 2) is automatically forwarded to the display of the hostel with 24-hour cover. The two SPAM displays were deployed in the two offices in October 2002. Since that time the units have been used on a daily basis.

5. TECHNOLOGY PROBES: GETTING DATA FROM SPAM

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

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

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

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

The SPAM machines perform their logging functions by appending messages to a plain text file. The SPAM application runs on a stand-alone miniature PC and all messages to log are generated by the SPAM main application. The GSM terminal is interfaced though a Java class sending and parsing AT commands, so much more debugging information about communication with the GSM terminal is available. This enables information sent to and from the GSM terminal to be logged.

Figure 3a shows a sample of the log file entries generated by the SPAM system for a message sent to Location A from Location B, figure 3b shows a sample of the log entries generated at

Location A when this message arrives. This is a mixture of debug output from communication with the GSM terminal, and 'higher-level' messages indicating that a message has been sent, received etc.

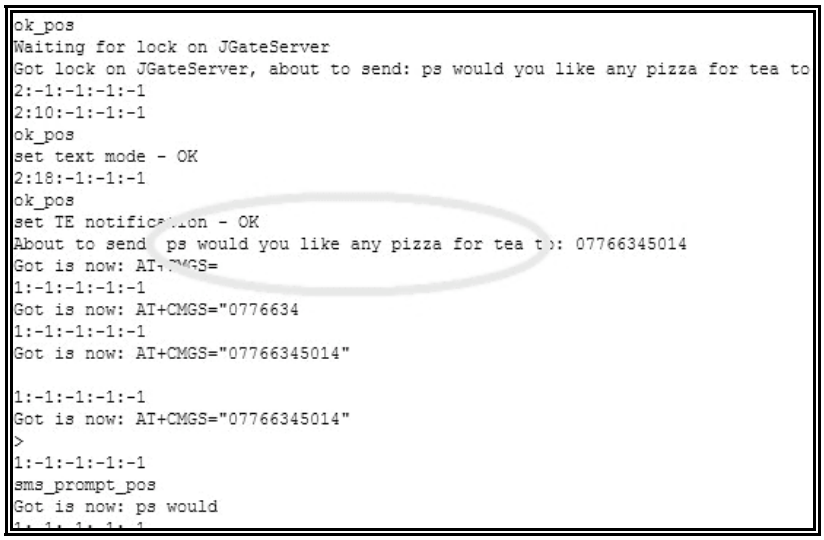

Figure 3a: Log of message sent from Location B to Location A

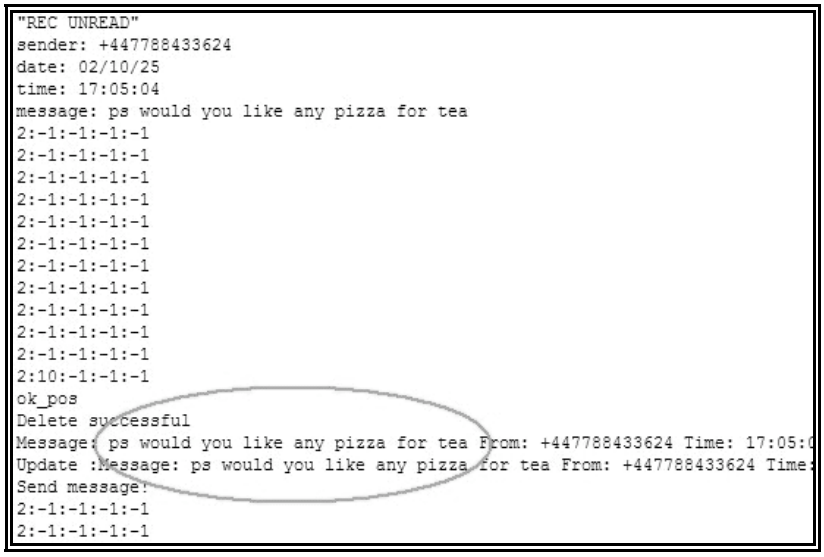

Figure 3b: Log showing message received at Location A

5.1 Working with Logs: Technical Issues

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

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

5.2 Rating the Logs: Problems with Ongoing Use

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

5.3 Interpreting the Logs: Problems with Analysis

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

6. UNDERSTANDING USER EXPERIENCE WITH SPAM

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

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

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

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

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

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

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

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

"SORRY IM GOING 2B LATE DARRIN"

"Blocked in snow will be late"

"Snow problem please ring Barbara"

"Penny am with mr gate closed bvt not locked"

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

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

Like Nardi et al. (2000) we are interested in understanding the communicative *functions* of texting - of the use of texting for quick questions and clarifications, for example (e.g., "Do you know if Helen has any medicine"; " Wot time is Paul calling to c hh"). Similarly, there is evidence in the logs that texting is useful for various kinds of coordination. Texting is particularly useful to coordination when immediate responses are required (e.g., "D ... XXX has to have blood test at cc at 10 30 i will take him can you tell him to be ready - let me know if you have got message" - "Got message have cancelled his taxi"). However, the use of text also extends to coordinating the use of technology when, for example, a conversation is complicated and/or involves too much typing (e.g., "Please phone house when you are able"). In other instances texting is relied upon when other technologies (phone, fax, email, etc.) are in use or are being kept clear in the anticipation of urgent use and to alert others on occasions where technical failures occur (e.g., "Put the phone on to answerphone"; "Please switch the mobile phone on"; "u r blocking the phone line after someone telephoned here it sounded like mike. Please sort out as we can not use the mobile if needed").

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

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

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

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

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

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

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

Of particular interest to us is what Nardi et al. characterise as 'outeraction', where text messaging does more than support rapid informal communication but also facilitates practices that make communication possible. Such practices include negotiating the availability of others for conversation (e.g. "Please phone the house when you are able"). Such negotiation requires some sensitivity towards the work and pace of work of others and involves recognizing appropriate and inappropriate times to contact others, appropriate modes of interruption, and so on. Texting allows people to address the kind of issues on which communication turns in that it is less obviously 'in your face' than some other forms of communication. It permits delayed response or easy acknowledgement (pressing the acknowledgement button), for example, and at the same time facilitates multi-tasking, allowing workers to monitor texts whilst engaged in other jobs. The logs suggest that texting in the

hostel allows workers to negotiate their availability and maintain their connection with the rest of the staff. Knowing who is around, what people are doing at weekends or during sleepovers at the main hostel, for example, enables workers to establish and project a range of possible interactions, much as the door displays at the university allow people to project appropriate course of action in response to messages left by staff. Texting, in other words, enables users to *plan* joint activities as much as it enables their coordination.

6.1 Concluding Remarks

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

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

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

technology is embedded and used. That knowledge is used to interpret the data but is *not contained within the data*. Consequently where the evaluation of the functional value of collaborative systems is concerned there remains a continuing need to exercise caution.

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