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Exploring Awareness Related Messaging Through Two Situated-Display-Based Systems

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ABSTRACT

This article focuses on our exploration of awareness issues through the design and long-term deployment of two systems: the Hermes office door display system (which enabled staff in a university department to post awareness messages to their door displays) and SPAM (a messaging system for supporting coordination

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between staff at two associated residential community care facilities). In the case of both systems, a significant number of the messages sent could be classified as relating to awareness. Furthermore, with both systems, the situatedness of displays (outside office doors in the case of Hermes and in staff offices in the case of SPAM) had a significant impact on the design and subsequent use of the deployed systems. In particular, the placement of displays provided significant context for awareness messages, including, for example, the identity of the sender of the mes-

sage and the intended audience of the message. Both systems highlight the need for interaction methods that fit in with both normal working practices (and unplanned events) and that enable the user to manage communication channels. The need for appropriate levels of expressiveness and user control is also apparent: We present numerous examples of users controlling the precision of awareness information and sending awareness messages that have as much to do with playfulness as supporting coordination through activity awareness.

1. INTRODUCTION

This article focuses on our exploration of awareness issues through the design and long-term deployment of two situated display based messaging systems, Hermes and SPAM.

The Hermes office door display system was deployed in the Computing Department at Lancaster University (see Cheverst, Dix, Fitton, & Rouncefield, 2003; Cheverst, Fitton, & Dix, 2003). The system ran for approximately 27 months until a move to another building in June 2004. The number of door display owners during this period was 12 (although only 10 units were ever deployed at one time). Owners included lecturers, research assistants, PhD students, and administrative staff. In terms of functionality, the primary purpose of Hermes was to enable support for coordination both among staff and between staff and students. For example, on one occasion a lecturer and owner of a door display, to let visitors know that he would shortly arrive at his office, “texted” to his display the message.

“On bus — in shortly”

In developing Hermes, we were particularly interested in exploring whether some of the traditional methods for supporting coordination through sharing personal information, such as placing a sticky note outside one’s office door, could be achieved with a digital equivalent that might provide different or enhanced properties and affordances and encourage or encompass different patterns of use, such as remote interaction.

The SPAM system was a messaging system (Cheverst, Clarke, et al., 2003) designed to support coordination between staff at two associated residential community care facilities for ex-psychiatric hospital patients. As with Hermes, this system has also been deployed in the long term (over 2 years), and all messages sent using the system have been logged. Again, the location of the SPAM units (flat touch-screen displays showing incoming SMS messages) is a significant aspect impacting on the design and use of the system: SPAM units are placed in semipublic offices that can be frequented by residents as well as staff. Thus guarding against the inappropriate reading of certain mes-

sages by residents was a critical issue. In common with Hermes, following analysis of a sample of logged messages, we found that a significant number of the sent messages could be classified as relating to awareness. Also in common with Hermes, remote interaction with displays was supported. For example, one member of staff, when snow blocking her driveway stopped her driving to work one morning, sent the following message via SMS to the display in her office:

“Snow problem please ring”

The table in Figure 1 briefly highlights the differences and similarities between the two systems.

As always with this kind of work there is a tension between the particular nature of the deployment contexts and the desire to generalize the results to enable future design. In this article, we largely utilized qualitative analysis informed by some more quantitative measures derived from raw data. This approach reflects the fact that we would not expect to see the same numerical patterns of usage across the two systems but rather that we expect themes that emerged during their use to recur in future deployments in new situations. In our quantitative analysis we have used a sample of the logs (300 messages for Hermes and 360 messages for SPAM), which we believe is suitably representative given the level of precision we require—namely, that we wish to uncover broad classes of behavior, not theorize concerning precise frequency of occurrence. In our qualitative analysis we have relied partly on our own enculturation gained through personal experience of the settings and examination of ethnographic and field data and partly through broad shared understandings of “what is going on” at the settings.

The remainder of the article is structured as followed. Sections 1.1, 1.2, and 1.3 discuss our understandings of terms crucial to this article, namely, situated displays, place, situatedness in general, awareness, and the interrelationship between these terms. The final part of the introduction (Section 1.4) discusses previous research related to the support of awareness by situated display based systems. Sections 2 and 3 describe the Hermes and SPAM systems, respectively, and the usages and themes (relating to awareness) that emerged from their long-term use. Section 4 discusses further issues relating to awareness that were common across both systems. Section 5 presents some concluding remarks.

1.1. Situated Displays and the Importance of Place

Research into situated displays belongs in both the Computer Supported Cooperative Work (CSCW) and Ubiquitous Computing (see Weiser, 1991) fields and has received considerable interest in recent years due in part to the

Figure 1. Table comparing key features of the Hermes and SPAM systems.

System	No. of Units	Months Deployed	Placement	Dominant Communication	Potential Reader/Recipient of Message	Messages Sent per Unit per Months (<i>M</i>)	Total Messages
Hermes	10	27 (first deployed April 2002)	Office doors in university department	Typically broadcast and asynchronous in nature	Open group recipients (passersby to office, etc.)	Approx. 17 messages sent by each owner per month	Approx. 5,500 (over 27 months and 12 different owners)
SPAM	2	36+ (first deployed October 2002)	Staff rooms of residential care facility	More synchronous in nature	Closed group recipients (1-2 staff at one time but occasionally residents also in staff office)	Approx. 36 messages sent per month from each site	Approx. 2,500 (over 36 months)

widespread availability of cheap and reliable display devices (across a range of sizes), wireless communications, and various sensing devices. From a technical perspective, the availability of these technologies enables deployments to occur at a relatively low financial cost. Furthermore, the widespread adoption of personal communications devices such as mobile phones provides an additional avenue to support interaction with situated displays.

When we refer to situated displays we agree strongly with the definition provided by O'Hara, Churchill, Perry, Russell, and Streitz (2002) and the possibilities they raise:

- (1) 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.

It is on the use (novel and otherwise) of situated displays to support group work that we focus in this article. In examining this, we acknowledge that this use sometimes extends beyond the intentions of the designer(s) and that significant understanding is required in order to avoid inappropriate deployments. Indeed, fundamental to this notion of situated is the notion of *place*, which Harrison and Dourish (1996) defined as "a space which is invested with understandings of behavioural appropriateness, cultural expectations, and so forth" (p. 69).

Thus the notion of place encompasses not only the physical aspects of the environment and the constraints these impose on behavior (such as group activity) but also what actions and patterns of behavior are *expected* there and the particular routines that have *developed* there over time.

1.2. Dimensions of Situatedness

Although the displays on which messages appear are situated, the messages themselves can also be considered as situated—not simply due to inheriting context from the placement of the displays but from a number of other dimensions. Consider, for example, the common "Out for lunch" message appearing on a Hermes door display. If this message appears on an owner's door display then the placement of the message clearly associates the message with the particular owner. Furthermore, both the placement and the fact that the message is not addressed to a particular person imply that the message is deliberately being broadcast to any person passing by the owner's office (only a subset of who is likely to be particularly interested in this piece of information).

The location also has potential cultural significance; for example, some cultures have more relaxed lunch periods.

Although placement is clearly an important dimension, another significant dimension “situating” the message is time. Consider, for example, the implications of the message being viewed on a Friday at 10 a.m., at 12:30 p.m., and at 2 p.m. At 10 a.m. a visitor to the door might simply assume that the office owner has not reset the message on her door display. At 12:30 p.m., the visitor might assume that the message is accurate and that the visitor might be away for some time. At 2 p.m., the visitor might also assume the message to be accurate but might hold some doubts and anticipate the imminent return of the message owner.

Of course, shared knowledge of rhythms and routines and the anticipated audience of messages also have significant impact. It may be common knowledge to those in the department that on a Friday the office owner typically has an extended lunch break starting around 1 p.m.—understanding that this is common knowledge, the owner may consider the simple form of message sufficient. However, if the owner anticipated a possible visit by someone from outside the department, then she may choose to provide more information.

Such a message may also have particular significance in the context of messages placed in the immediate past and what may be expected in the future. If the message was preceded by an earlier message “Around all day,” then her potential availability later in the day is more assured than if no earlier message had been left and no such assurance had been made. In addition, the message is also situated in its immediate surroundings. For example, the message could have a different meaning if it is placed next to an open door than if the same message is placed next to a closed door with a light visibly switched on in the room.

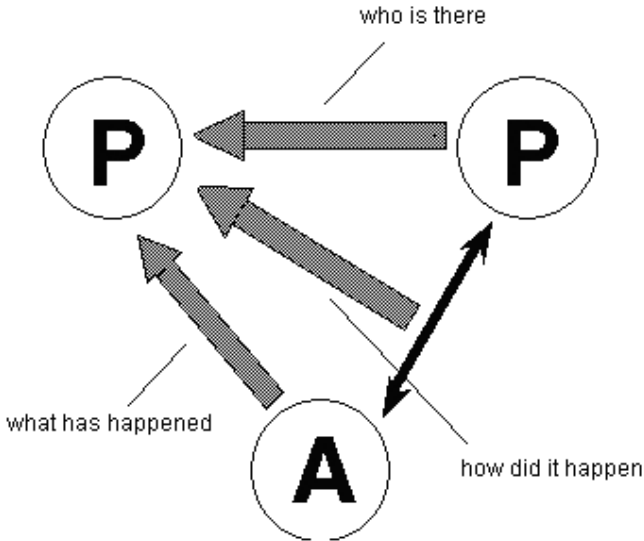
1.3. Definitions of Awareness

Awareness is a common term in human–computer interaction and CSCW but has many different meanings. Often this is left unstated, but a few authors have attempted to articulate more precisely what constitutes awareness. Schmidt and Simone (2000) distinguished four levels or kinds of awareness:

1. Perception of the field of work.
2. Inferences from that to enable indirect perception of activities of others.
3. Direct perception of “bodily conduct” of others, which includes (a) their focus of attention and (b) overheard conversations, and so on.
4. Overheard parts of other participants’ explicit acts to coordinate their awareness with each other.

Dix (1997) distinguished three kinds of awareness in the context of a CSCW framework (see Figure 2):

Figure 2. Awareness in the CSCW framework (Dix, 1997): P – participants in collaboration; A – shared artifacts of work.



1. Who is there—who is around and their availability.
2. What has happened—what things have altered or been changed in the shared environment.
3. How did it happen—what were and are the things that people did to make things the way they are.

Schmidt and Simone's (2000) first category corresponds roughly to Dix's (1997) second category and relates to the current state of the work environment. Schmidt and Simone's second category and the first part of their third correspond to Dix's third category in the way in which things are or have happened. Note all of these are related to the work environment and the things in it; in the vocabulary of Dix's CSCW Framework they are focused on the "Artifacts of Work."

In contrast, the second part of Schmidt and Simone's third category and their fourth and Dix's first are about the people in the situation directly, not so much their effects on other things. Virtually all the awareness information reported in the literature related to situated displays seems to be in these people categories, and we see in section 4.2 that this is also the case with Hermes and SPAM. However, because of their situated dimension, the issue of location is often central. Dix's CSCW Framework is focused around the relationship be-

tween people and artifacts, and Schmidt and Simone's analysis has the same underlying assumption. In contrast, the awareness in this article is about the relationship between people and place: who is (or is not) where and why.

Schmidt and Simone (2000) also pointed out two other critical dimensions of awareness: level of attention and reflexivity. On the former they noted that awareness is used to include phenomena "from peripheral awareness to focused attention" (p. 5).

Most of the awareness mechanisms for situated (especially office) displays seem to be more explicit: visitors reading calendars etc. However, the location of displays can also make it possible (or not) for passers by to notice (or become aware without consciously noticing) the general activity of others.

The issue of reflexivity is central to situated displays. Schmidt and Simone (2000) discussed the way in which participants orient themselves to expose their activities to others and hence make their actions and so on intelligible. This orientation may be very explicit, or more subtle (and possibly unconscious). For example, it is possible to explicitly leave a note on an office door saying "in the building, but not in my office," however, one of the authors will instead simply lock his door but leave the light on, which, because the walls are glass, more subtly gives the same message. In all the published studies of situated and office displays we know about, awareness information is explicitly supplied and often also codified "In office," "Away," and so on. We see in many examples how, when given a suitably rich medium, the supplier crafts this awareness information on situated displays beyond simple codified responses. Schmidt and Simone pointed out that this reflexivity in awareness is also played out by the recipients of awareness cues as they orient themselves to make their reception apparent. However, the nature of most public displays means that this is uncommon. In fact SPAM is an exception as its potentially "mission critical" nature means that knowledge that others are aware of your critical situation is necessary. In section 3.2 we discuss how a technical means (automatic responses) allows the sender to be sure that a message is being displayed. The situated nature of the display (in an office that is normally occupied) serves to complete this assurance without explicit "I've got it" replies.

As we noted, awareness information on situated displays is often (naturally) related to location (or activity as a proxy for location). A simple awareness message such as a sticky note saying "Out of office" posted on an office door may carry several simultaneous meanings:

- Position: what I am doing / where I am.
- Negation: what I am not doing / where I am not.
- Explanation: why I am not doing it / why I am not somewhere (often here!).

Often, only the first of these is explicit in the message, but others may be implicit. In the case of the “Out for lunch” note, it says

- Position: I am eating lunch (explicit).
- Negation: I am not in my office (implicit).
- Explanation: I am not in my office because I am eating lunch (implicit).

Of course, to someone who knows the person posting the message “Out for lunch” it may mean that the reader can guess where the “lunch” is. The awareness also often has a temporal as well as spatial connotation; “Out for lunch” carries an implication “Not in my office now, but likely to be *after* lunchtime”.

1.4. Situated Displays and Awareness

Foundational research into the issues arising from the use of situated displays to support cooperation between work colleagues was carried out at the Xerox Media Lab in the early 1990s. In particular, researchers at Xerox deployed and evaluated (over many years) the Portholes shared video space to study the potential for supporting coordination between work colleagues through peripheral awareness (Dourish & Bly, 1992) and to explore the control/privacy issues that naturally arise from the deployment of such a system (Dourish, 1993).

With both of the field studies described here, the situatedness of displays (outside office doors in the case of Hermes and in staff offices in the case of SPAM) had a significant impact on the design and subsequent use of the deployed systems. When considering this work, it is important to note previous work based on situated displays that supported notions of awareness.

Significant work in this area has been conducted by O’Hara and colleagues. For example, the RoomWizard system (O’Hara, Perry, & Lewis, 2003) comprises an installation of PDA-sized display appliances situated outside of meeting rooms, providing the functionality to book a meeting room (locally and via the Web) and check if a meeting room is available. Ethnographic techniques were used to investigate “meeting practices” before the installation of RoomWizard and again during the deployment and use of the system. This enabled the identification and investigation of a set of issues arising from this use, for example, unexpected functions such as enabling peripheral awareness and navigation. O’Hara et al. (2003) also noted that complex usage patterns built up around what was effectively a very simple appliance: “Whilst the RoomWizard at first appears to be a simple electronic duplicate of a room reservation system, it is far more complex than this in use” (p. 71).

Another significant piece of work by O'Hara and colleagues is the Txtboard system (O'Hara et al., 2005), which again takes the form of a small display, in this case designed to be mounted on a wall in a home environment. Txtboard incorporated a mobile phone to allow the reception of SMS messages which, once received, were displayed using all the available screen area. A study describing the use of Txtboard by a family over 2 months revealed several aspects of use, most notably the importance of the placement of the displays. O'Hara et al. (2005) concluded that part of the success of TxtBoard was its simplicity:

Nevertheless, TxtBoard succeeded in large part because it offered a minimal addition to the home: that is to say, that in offering so little, it made a difference that was worthwhile. In sum, this study of TxtBoard shows that less can be more. (p. 1708)

This notion of simplicity and offering users a "lightweight" means for interaction is an insight that resonates strongly with our experiences of the Hermes and SPAM deployments.

Another example of work on situated displays that (at least in part) support notions of awareness is McCarthy's work on the OutCast system/service (McCarthy, Costa, & Liongosari, 2001). This provided "information about the owner that is intended for others to view" (p. 338).

The OutCast system used a relatively large touch-screen display, which would be embedded in a cubicle (office) wall and connected to a computer situated inside the owner's office. The OutCast system could be configured by its owner to display a range of content, including information to support general awareness, for example, public calendar entries captured from the owner's Outlook calendar or location information obtained from the owner's infrared badge.

Work at Carnegie Mellon University is exploring how office doors can be augmented with computer-generated displays to support the functions of aesthetic display and interruption gateway (Nichols, Wobbrock, Gergle, & Forlizzi, 2002, p. 1). In terms of display technology, the system actually projects an image onto a window in the office door from a projector located in the office. This approach produces a relatively large image that is viewable on the public side of the office door. The information projected onto the office door is of three main types: virtual notes, digital art (e.g., Web pages, personalized graphics, etc.), and awareness information. The presentation of awareness information utilizes a system called StatusLight, which utilizes a simple traffic-light metaphor to enable users located in the office to stipulate their interruptability. Investigations into the observed usage of the system were cited as planned future work (Nichols et al., 2002).

Research exploring the ways in which situated digital displays can be used to support and foster small communities has been carried out by Greenberg and colleagues through work on the Notification Collage (NC) system (Greenberg & Rounding, 2001). This groupware system, developed and evaluated by a small research group at the University of Calgary, enables distributed and co-located colleagues to post media elements (e.g., live video feeds from desktop Web cams or activity indicators) into either a public space (a large display in an open area such as a common room) or a private setting (e.g., a workstation display—typically on a secondary display). According to Greenberg and Rounding, “user experiences show that NC becomes a rich resource for awareness and collaboration. Community members indicate their presence to others by posting live video. They regularly act on this information by engaging in text and video conversations” (p. 1).

They also described the obdurate problem of managing appropriate privacy and distraction when supporting awareness in a system such as NC—such observations echo the insights described by Hudson and Smith (1996).

2. AWARENESS IN THE HERMES SYSTEM

The Hermes office door display system was deployed in the Computing Department of Lancaster University. The first Hermes unit was installed outside an office in April 2002, and additional units were installed over a 9-month period. The Hermes system ran for nearly 27 months and is cur-

Figure 3. The Hermes deployment: Left side displays outside offices, and right shows a close-up of a display showing an owner's textual message.



rently being re-engineered for deployment in a new department building. Hermes door displays took the form of PDAs in a metal casing (see Figure 3b), which effectively turned the devices into information appliances by removing access to the PDA's buttons and (consequently) applications other than the Hermes software. A view along one of the Computing Department's corridors showing three of the deployed door displays appears in Figure 3a.

When developing the Hermes system we were very much interested in the "place" (immediately adjacent to office doors) where these units would be deployed, a place that possesses both private (in terms of being a location closely associated with the owner) and public (in terms of facing a public corridor) elements.

It should be noted that the examples described in this section occur within the context of other mechanisms for communicating awareness, such as e-mail and even an office door. Nichols and colleagues (2002) made a relevant comment about the nature of office doors:

Office doors are more than entrances to rooms, they are entrances to a person's time and attention. People can mediate access to themselves by choosing whether to leave their door open or closed when they are in their office. Doors also serve as a medium for communication, where people can broadcast individual messages to passersby, or accept messages from others who stopped by when the door was closed. (p. 1)

Nichols et al. illustrated how office doors themselves, even without a glass window, can support "social translucence" (Erickson & Kellog, 2000) through making information visible and thereby bringing social norms into play.

The idea of the Hermes system was that it would supplement existing approaches toward enabling awareness, whether that is leaving one's door ajar or sticking on a note saying "Gone for coffee, back soon." Interestingly, it was eventually an office door metaphor that was used at Xerox with the Portholes system to limit access to the office video. Although clearly a virtual door in this case, the Portholes deployment does serve to highlight the important cultural affordances of the door.

2.1. Evolution of the Hermes System

The Hermes system evolved in a series of phases through its deployment. Initially only two units were deployed on the offices of system developers (two of the authors), but over time (and as the reliability of the system increased) further units were deployed. The phased development was used to respond to comments made by users (obtained through questionnaires, semistructured interviews, and informal conversations in the workplace),

such as requests for additional methods of interacting with the system. For example, one owner made an explicit request to be able to set messages via MSN Messenger (see *The Importance of Fitting in With Existing Routines* section for more details).

Although costs limited to 10 the number of displays that could actually be deployed, during the deployment period, 12 owners made use of the system (4 of these were authors of this article). The owners of Hermes door displays included lecturers (who would often be away from the department at conferences or would sometimes work from home), research assistants, PhD students, and several administrative staff.

Although substantial efforts were made to improve the reliability of the system, some users encountered a significantly lower level of reliability than others. For example, one owner (a secretary) had a door display located in an area of intermittent wireless connectivity. Consequently, she encountered several failures when attempting to use her door display to share awareness information, and (not surprisingly) she eventually lost confidence in the system. For other door display owners, the number of encountered failures were less and the usage of the system more significant.

Other door display owners coped well with a small number of failures and found the Hermes system a valuable part of their daily patterns. One owner (a lecturer in this case) who used the system to display between 5 and 10 messages a day (the majority relating to awareness/presence information; see Section 2.4) made the following comment:

I guess it's public spirited, it's trying to help people to be aware of what I'm doing and being able to find me more easily, or work out whether I'm available, or when I'll be back or something.

Another owner (a secretary) commented that she liked that the system helped other people to find her when she was away from the office. This secretary was a previous user of a message whirler (a cardboard disk mounted on her door that could be rotated to reveal appropriate awareness information, such as "Photocopying") and that she abandoned using the whirler after receiving her own Hermes display (although the whirler remained stuck to her door).

The Hermes system was dismantled in July 2004, and working prototypes of a new version of Hermes (Hermes 2) were deployed in the new department building in December 2006. A full deployment across two corridors and 40 offices was completed in May 2007. From the user's perspective, one significant change from the original Hermes system is the use of a larger 7-in. widescreen display; this larger screen was chosen by the majority of door display owners from the original Hermes system during a showcase study in

which a variety of display options (based on high-fidelity prototypes) were presented to previous owners (see Fitton et al., 2005, for more details).

In common with many such technology deployments, the users included the developers themselves and their close colleagues. This process obviously runs the risk that users were “being helpful” to the researchers and that usage does not reflect true deployment. Although this undoubtedly had some effect, we do not believe this fact seriously diminishes the reliability of our own results. First, these “being helpful” effects are not long lasting. It is common in reports of experimental technology deployments to see usage levels that rapidly peak, followed by rapid decline, to disuse. Instead we saw usage that, although sometimes sporadic reflecting personal circumstances, was relatively uniform in the long term, suggesting that the system was being used for its own sake. Second, users varied widely in their patterns of use and in particular were not shy to disregard or discontinue the use of features that did not fit their personal work patterns. Third, the system was to some extent (although less than SPAM) “mission critical,” and hence users were not forgiving. This included the authors themselves, one of whom never used the ability to send messages to his display via SMS because of an early “bad experience.” So we feel that the worst potential dangers of being too close to the users were avoided. On the positive side, the personal knowledge of the users and their context and habits made the analysis of (often idiosyncratic) messages in the system logs far more tractable than it would have been for strangers.

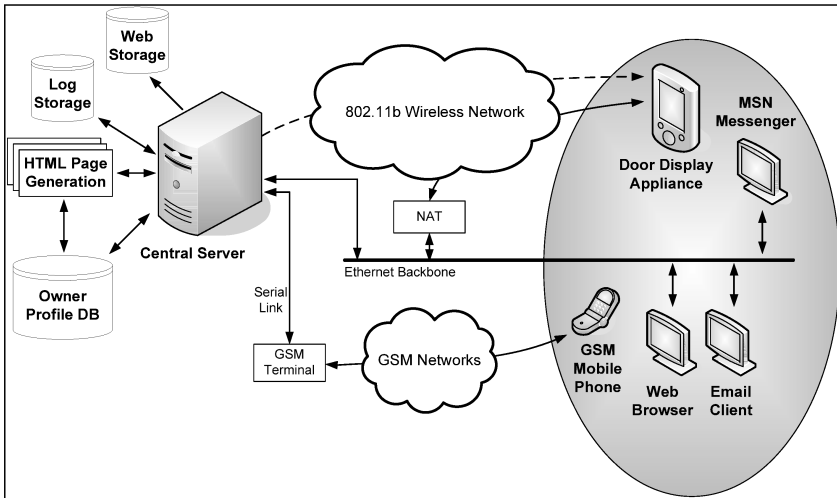
2.2. Typical Scenarios of Use

In terms of functionality, one of the primary purposes of Hermes was to support general coordination between lecturers, secretaries/technical support staff, and students. For example, it was envisioned that a lecturer and owner of a door display, so that students coming to her office would know to wait, might “text” to her door display a message such as “Stuck in traffic jam—will be 30 min late at least.”

With Hermes, we were particularly interested in exploring whether some of the traditional methods for sharing personal information (e.g., sticking a note outside one’s office door) could be achieved with a digital equivalent that might provide different or enhanced properties and affordances and encourage or encompass different patterns of use, such as remote interaction. In effect, we were interested in the extent to which the system would support coordination between colleagues through the provision of awareness information.

The system architecture of the Hermes system is shown in Figure 4. This figure illustrates how the door displays were connected to a central server via a wireless 802.11 network (this service was experimentally available in the department when Hermes was being designed). The central server was responsible for running the

Figure 4. The systems architecture of the Hermes system.



Hermes application and for storing the messages set by owners and those entered by visitors to the door displays (such visitors could use an attached stylus to scribble a message on the display's touch screen). The server was also responsible for accessing a database storing owner preferences and for log storage (including the storing of fine-grained graphical user interface actions by the user in addition to all messages). Figure 4 also illustrates the various ways in which an owner of a door display could set a message, that is, by texting using their mobile phone, through a Web browser interface, via e-mail, through an MSN messenger client, or by using the touch sensitive screen on the door display itself.

2.3. Analysis of Usage Logs

An analysis of a sample log of 300 messages (captured over a 5-month period commencing in November 2003 from all owners who set a message during that period) was carried out by three of the authors (all of whom were owners of door display units). This period of usage was chosen because by November 2003 Hermes owners had been using the system for many months, and so it could be assumed that usage patterns had started to stabilize. Furthermore, the 5-month period represented a continuous period of usage during which no major modifications were made to the system and during which the system did not suffer any significant periods of downtime; by November 2003, early reliability problems had been rectified.

The first analysis carried out on the logs was to determine the extent to which owner's set messages shared context in one of the three categories: Activity, Temporal, and Location. Analysis relating to these three specific categories is presented in detail in Cheverst, Dix, et al. (2003).

This analysis revealed that approximately 80% of the total number of messages appearing in the log related in some way to the notion of supporting awareness, relating in particular to the notion of presence. A sample of the log file (including tags identifying how owner's set messages shared context in one of the three aforementioned categories) is shown in Figure 5.

Of the 300 messages analyzed, 48 were either test messages or edits, the latter being messages that represented basic corrections/clarifications of a preceding message that took place within 3 min of the initial message being set. For example, in the log sample being used, the following message was set by a lecturer to appear on his door display:

away @ Cheltenham getting Honorary fellowship Wed& Thurs, back in on Friday

Figure 5. Sample of the tagged Hermes log file.

User Name: Adrian Friday
 Time: 20:35
 Date: 11/03/03
 Message Type: TEMPORARY TEXTURAL
 Message: Away at CORTEX workshop. Back Monday (probably no email in the meantime!).
 Context: TEMPORAL ACTIVITY

User Name: Keith Cheverst
 Time: 12:32
 Date: 13/03/03
 Message Type: TEMPORARY TEXTURAL
 Message: At CORTEX mtg in Ambleside Thur pm + all day Fri
 Context: TEMPORAL LOCATION ACTIVITY

User Name: Alan Dix
 Time: 12:33
 Date: 15/03/03
 Message Type: PUBLIC TEXTURAL
 Message: meeting in Paris Monday, back in Tuesday 18th March
 Context: TEMPORAL LOCATION ACTIVITY

but within 3 min the lecturer changed his displayed message to:

away @ Cheltenham getting Honorary fellowship (am I getting that old!) Wed&
Thurs, back in on Friday

In the remainder of this article, we refer to the set of 252 messages as being *valid* messages.

2.4. Emergent Usages and Themes Relating to Awareness

This section presents a qualitative analysis of the usages and themes that arose from observing how the deployed system was used by the various door display owners in ways relevant to notions of awareness.

To obtain feedback from door display owners, a variety of “formal” methods were used (in addition to chance conversations with owners at the drinks dispenser, etc.). In April 2003 a questionnaire was given to the 10 door display owners at the time. (This questionnaire was used to obtain feedback on potential modifications to the system and is not of particular relevance to this article.) A follow-up and more comprehensive closing questionnaire (based on a 5-point scale) and associated semistructured interview (which lasted between 30 and 90 min) were carried out by one of the authors (who was a door display owner himself), with the remaining 11 Hermes owners (recall that 12 users owned door display during the deployment period) during the months of August and September 2004; the analysis presented in this article is based on feedback from this latter questionnaire.

Questions explored a variety of pertinent issues such as user expertise, context sharing, dependability, and trust. One example was “When not in my office I find it more acceptable to share information about my activity (e.g. gone to lunch) rather than my location (e.g. gone to lunch at the Venue).”

Users were asked to respond on a range from *strongly agree* to *strongly disagree* and were given space in the questionnaire to provide any comments raised by the question.

The Hermes system was also very much “lived” by the investigators in the Computing Department at Lancaster; four of the authors owned door displays. Thus the themes discussed next emerge not only from the analysis of logged message and responses to questionnaire items and interview questions but also from the subjective, personal, and shared experience of living with the system.

Maintaining a Sense of Presence/Reason for Absence

One common use for messages set on Hermes door displays was to provide a sense of presence when away from the office. One typical example was

“Working at home today—reviewing papers.”

Another example was

“Working at ISS this morning.”

This latter message was set by a lecturer who divided his time at the university between two departments (he had an office with door display in each); for him, the sharing of awareness information to help colleagues determine his current or future location was his primary use of the system.

Another common use for messages was to provide an indication of why the person was not in the office, but in a way that they can be contacted if necessary; for example, a popular message left by secretaries was simply “Photocopying.” Similarly, other staff would leave messages such as “Lecturing.” Note that both these messages provide additional information over and above the fact that the office owner is away. This information might relate to the activity (e.g., “Reviewing papers”) or the location (e.g., “At home” or “At ISS”). Of the 252 valid messages, 229 (91%) related to the provision of presence information; of these, 172 messages (75%) provided information regarding the owner’s location or activity. Messages that provided temporal information (e.g., “In today”) implied that the person was going to be available for a face-to-face communication that day, even if the visitor found them to be away from their office at that particular point in time.

Through the semistructured interviews, we discussed with door display owners their reasons for deciding what was an appropriate level of information to share on their display. One secretary made the following comment when asked whether she had considered leaving additional information (e.g., location) to her (frequently used) “Gone for lunch” message:

It’s not something that I’ve even thought of before, just “gone for lunch” I think is enough information, I’ve never even considered saying where I’m going for lunch ... I don’t do it so nobody can find me, it’s just gone for lunch, that’s it!

A different secretary commented how she strongly preferred to share information about her activity (in this case, gone for lunch) and expressed concerns about people coming to see her when at lunch outside of the department, stating “people only need to know that I am not available in my office, not necessarily where I am.”

Two Hermes door displays owners (both secretaries) stressed (quite reasonably) that they did not want to be contacted when outside of the Computing Department or during their private time, such as on a lunch break. One of

these owners said that she would lock her office door and change her display to say “Out to lunch” when eating lunch in her office.

When asked to expand on this issue of “how much information is enough.” one secretary commented on how her messages were “well chosen” and that “if someone knew I was at the photocopier they would know where I was and be able to estimate how long I might be.”

A lecturer also commented how he found it more acceptable to share information about his activity rather than this location, primarily to protect his privacy, but was interested in sharing different granularity of information under different circumstances:

You don't want them tracking you down while you're down at X or gone for lunch. Whereas if it was someone who had some urgent problem that they wanted sorted out then you might be a little less upset if they turned up at X saying “I've got this immediate emergency, can you help?”

The “I'm Not Here but I Should Be” Awareness Message

One common use of the system was to display a message of the form “I'm not here but I should be”. Of the valid messages analysed, 4 were SMS based messages and all 4 of these messages related to this category. One example of such a message left by one of the department's lecturers is “in q at post office.”

The response given by the lecturer who set this message was as follows:

I've definitely used it when I've had people coming to meet me here and I've been stuck, I was definitely stuck at the post office queuing once, I've been stuck on the bus, all sorts of places, and I've texted in and said I'm going to run late, and I've used that 3 or 4 times I guess

Privacy, Control, Accuracy, and Placement Issues

As described in Section 1.2, the location of a display is one of the key dimensions when considering the situatedness of a message. We were interested in exploring the extent to which owners wanted the visibility of their messages to be constrained to their door displays.

To explore this issue we asked owners (as part of the closing semistructured interview) to comment on their agreement with the following statement: “I would be happy for anyone to view the message on my doorplate remotely over the Web.” One of the owners was not sure; 7 of the owners disagreed (one strongly), citing security concerns; and 4 owners agreed. Note that there was no significant relationship between the professions of the owners and their responses to this question. For example, 3 of the 4 secretaries who were owners of door displays responded with disagree (1 strongly), whereas the

other secretary responded with agree. Two of the owners who agreed described how they would alter their messages to make them vaguer, whereas one display owner described how she would make her messages more accurate, as people may be traveling long distances across campus to visit her office (the accuracy issue is discussed further in Section 4.3). One of the owners who disagreed commented on the privacy implications of making his messages widely accessible; his comments clearly imply that the placement of his door display reduced his privacy concerns as it restricted access to his messages to a specific community:

There is a community associated with my doorplate, you know people have to be able to get to my doorplate, and that probably makes them one of the staff or colleagues, and that affects what information I could put on there and I don't want burglar Bill with his web browser to go—oh look Ade's in such-and-such I'll go and burgle his house now.

To investigate these issues further, the following questions were used: “Given that anyone could monitor my doorplate (e.g. to see when I am in or out) this would this affect the content of my messages” and “I would be happy for staff in the department to be able to view my doorplate remotely.”

Eleven of 12 owners agreed (4 strongly) to the former, whereas all owners agreed (6 strongly) to the latter statement. One typical comment associated with the latter was: “If you can't trust the people that you work with, well ...”.

We were also interested in following this issue up further with regard to the issue of privacy and so hypothetically “raised the stakes” by asking owners to consider the situation in which Hermes was used to display their sensed location (i.e., assuming some form of tracking service). We asked owners to comment on the following statement: “I would like to have my location sensed and displayed on my doorplate (e.g., using active badge, active bat, etc.)”.

Four owners gave a negative response (3 strongly), 2 gave a positive response, and 6 owners were unsure. A range of responses were given; for example, one of the secretaries who gave a “not sure” response commented, “Sometimes you wouldn't necessarily want to be found.” One of the lecturers (and acting head of the department at the time) who gave an “agree” response commented, “It's important for people to be able to find me.” Alternatively, one of the lecturers who gave a “strongly disagree” response commented, “I wouldn't like it to say: half way down such-and-such a corridor, or on the toilet or something.”

The Importance of Fitting in With Existing Routines

The importance of fitting in with existing routines/patterns of behavior is one of the most important issues to have arisen through both informal conver-

sation and interviews with Hermes door display owners. When designing and developing Hermes it was crucial to identify and support interaction methods that fit in with the users existing tools and routines. For example, one owner, John, found the existing mechanisms available for setting messages inconvenient. However, he was a regular user of MSN Messenger and would often use this for providing awareness information to colleagues. He requested that Hermes be extended to enable him to set messages on his door display using his MSN Messenger client, and the system was modified to support this interaction method. Subsequently, this owner rated the MSN Messenger integration as his favorite feature of Hermes. In fact, quantitative analysis of use showed that his average daily usage increased significantly following the deployment of this feature. When expressing why he thought this was the case, he made it clear that not only was the interaction method very easy and simple for him to use, but it also fit well with his existing routines: "It wants to be something you don't have to go out of your way to do."

John has two offices at the university, one in the Computing Department and one in a different department. John described

What I would typically be doing is coming into computing at about 9 am in the morning that's where I'd use Hermes just to change the status for the pervious day to say that I'm in here. What I'm doing at the moment is tending to work in computing in the morning, spend a couple of hours here depending on the workload, and then I'll move across to X [the other department]. I'll typically update the status when I'm on my way out. Depending on what the workload is I may come back [to computing] at some time in the afternoon, so that way Hermes is really used for me - I use it as an indicator of when I'm here and when I'm there.

Other comments from owners described how the system had become part of their routine. For example, one lecturer commented, "I would update Hermes to say I'm working from home - it's part of my working routine." Another owner (a secretary in this case) commented how using the system had become part of a routine: "It's just a habit that you get into, a habit of leaving a message." This secretary already had a habit of sending messages to the departmental e-mail list, with a typical message being "away Friday pm back Mon."

To leverage on this existing pattern of use, we enabled messages to be set on her door display via an e-mail message. This meant that she did not need to drastically change an existing routine but simply had to include the appropriate Hermes e-mail address in the cc: field of the e-mail message. This owner commented that she found setting messages outside her office using the Hermes system more reliable than her previous experience of using sticky notes:

[Sticky notes] did tend to fall down, or you'd leave them on your door when you're in [laughs] you forget to take them off. They're not reliable [stick notes], because they just don't stay up you always end up having to stick sellotape.

Other patterns of behavior were also supported based on owner's evolved usage of the system. One significant example of this was support for default and temporary messages. The rationale for this feature is explained fully in Cheverst, Fitton, et al. (2003). Described briefly, it enabled the owner of a door display to set both a default image (e.g., a cartoon strip) and a temporary message (e.g., "gone for coffee"). If a temporary message was set, then this would occlude the default image but could be easily removed by tapping on the screen. Furthermore, following feedback that owners would often think to set a message only when leaving the office (thus seeing the office door display would act as a visual cue reminding the owner to leave a message), the system was modified to enable owners to set a temporary message by touching a button (representing one of a set of predefined messages) displayed on the door display itself (see Figure 6).

Appropriated (or Unintended) Use

The system was designed to enable owners to provide awareness information, and one of the affordances of the digital medium was that we could, in effect, restrict messages appearing on the door display to be only those set by the owner. As previously mentioned, one feature included in the system was designed to enable an owner to set a message on his or her door display by tapping on the screen to reveal a set of predefined messages (an illustration of a typical set of messages is shown in Figure 6) and then tapping again to select the desired message.

One example of appropriated use (meant here as use not explicitly intended by the designer) is demonstrated by one owner commenting that colleagues would occasionally update his door display if he forgot to do so, an unintentional feature afforded by the trading-off of security for ease of use:

I use it to say out to lunch, and it's quite interesting that the guys, if I don't, as I always set it to out to lunch as I walk out the door, if I forget, they set it to out to lunch for me, which I think it quite nice.

In general, we would argue strongly for the long-term deployment and observation of systems such as Hermes to provide important insights into how such systems are appropriated and "innofused" (Fleck, 1988) into real-world practices.

Figure 6. The Hermes interface for enabling owners to set a temporary via their own door display unit.

<p>Office soon - Kevin Lee Friday 13 June 2003 Please select a new message.</p>
Back shortly
In meeting
Out to lunch
Gone for coffee
Back tomorrow
Abandon

3. AWARENESS IN THE SPAM SYSTEM

The SPAM messaging system was developed to support coordination between staff working for a charitable trust based in the North of England. The charitable trust operates two facilities for people with severe and enduring mental health problems: a 10-bed, 24-hr residential hostel and, close by, a 7-day-a-week supported housing facility for 17 people. Each facility, at the time of the study, contained a staff office, and staff were given weekly rotas stipulating in which facility they would be required to work on any given day. Occasionally, staff would be required to move from one facility to another on a given day, for example, working the morning at the residential hostel and the afternoon at the supported housing facility. The trust employs approximately 10 members of staff for the two facilities at which SPAM units were deployed with a mix of both full-time and part-time workers. Taking into account staff turnover, and so on, for the period covered in this article, each SPAM system would have been used by between 5 and 7 different members of staff.

The SPAM system enables staff at the trust's two facilities to be able to communicate simply and effectively by sending text messages, which then appear on a touch-sensitive screen (located in a staff office at each facility) once the associated READ button has been pressed. The two SPAM units were deployed in October 2002; since then, the units have been used regularly. Figure 7 shows one of the de-

Figure 7. A deployed SPAM system in situ.



ployed SPAM systems in-situ and the system's simple user interface for reading new messages. The authoring of messages was achieved using an on-screen keyboard.

3.1. Evolution of the SPAM System

The evolution of SPAM used a variety of field and ethnographic methods: participant observation, in-depth interviews, and both Cultural Probes (Gaver, Dunne, & Pacenti, 1999) and Technology Probes (Hutchinson et al., 2003).

The first stage in the evolution of SPAM was to understand the care home setting, and our approach was ethnographic. Given the highly sensitive setting we used Cultural Probes (Gaver et al., 1999) combined with ethnography (Crabtree et al., 2003) to obtain insights into the needs of users and to sensitise ourselves to the setting. The Cultural Probes were highly successful in opening up a dialogue with users and involving them in the design process (Cheverst, Clarke, et al., 2003). Indeed, the level of communication was such that staff at the setting agreed to take part in a 1-day design workshop (held in December 2001). During the workshop (which was attended by six staff and two of the authors), a number of possible scenarios were outlined involving situations in which residents or staff members needed to inform the site of their circumstances by texting a message to some form of visible display in the staff offices. Following the discussion of these scenarios, possible problems and solutions were discussed. For example, one scenario involved the need for a member of staff to send a message to the staff office stating she

would be late for a staff handover because of complications at the local hospital with a resident under her care, but during discussions around this scenario one member of staff (correctly) commented that it was not permitted to send a text message from within a hospital building. The workshop also revealed a number of other circumstances in which some form of messaging system might prove a useful addition to current facilities. So, for example, members of staff reported that they often found it difficult to communicate effectively using only the phone:

You're working down at ... and the phone is constantly engaged at (Hostel).

Having a system just to contact (Hostel) ... because the phone's engaged most of the morning. ... Its just luck that you get through.

The overall response to the idea of a messaging system was therefore positive. In particular, such a system was viewed as another tool for communication capable of supporting staff in their everyday work and interaction with residents. In this respect, the participatory design workshops and Cultural Probes enabled us to meet what Edwards and Grinter (2001) regarded as a major challenge for designers, namely discovering

the stable and compelling routines of the home, rather than external factors, including the abilities of the technology itself. These routines are subtle, complex, and ill-articulated, if they are articulated at all. ... Only by grounding our designs in such realities of the home will we have a better chance to minimize, or at least predict, the effects of our technologies. (p. 263)

With regard to the particular messaging technology to be deployed, the manager of the care facility did not want to install an additional phone line and was positive about the idea of an SMS-based solution when such an approach was suggested; a brief presentation of the Hermes system was actually used as a technology prop (Howard, Carroll, Murphy, & Peck, 2002) to illustrate the concept of messaging to a display.

Prior to deployment the SPAM system received extensive testing, so when deployed the reliability of the system was generally good. Some problems have arisen over the monitored deployment period; for example, a failure with one of the GSM terminals in November 2003 took several weeks to rectify, and there were occasions when the SIM cards used by the system had run out of credit.

After a number of months a follow-up workshop (attended by five members of staff and two of the authors) was held in November 2002. This revealed the general success of the system. For example, one of the staff commented

... and we had a good thing the other night because there was a crisis down at Botcherby and of course the phone was tied up and we were waiting for people to phone back so they were just letting me know what was happening down the road.

The workshop also provided staff with an opportunity to discuss their usage of the system and any difficulties that they were experiencing. Two requests for modifications to the system were made by staff at the workshop. The first was for some form of blocking functionality that would enable the blocking of messages from a given mobile phone that had been used to send inappropriate texts (this was a mobile phone owned by one of the residents who had been given the number for texting to one of the SPAM units). The second request concerned the need to pick a slightly smaller font size so that any resident that entered a staff office would not be able to read (potentially sensitive) SPAM messages by glancing at the screen from a distance. Both requests were implemented within a few days of the workshop.

In June 2004 instructions were given on how to “top up” credit on the two SIM cards used by the system, effectively handing over some responsibility for the maintenance of SPAM to the staff members and the housing trust.

3.2. Typical Scenarios of Use

A typical use of the SPAM system is described in this vignette:

Jane wants to ask her manager about a resident’s medication. The Manager is currently at the residential hostel (Location B). Jane tries to telephone that site but the line is engaged. She needs the information now as the resident is asking her for more medication. Jane sends a text to the Manager using SPAM.

Figure 8 shows how SPAM supports this kind of interaction. The message is sent via a GSM terminal from Location A (the supported housing facility) to Location B (the residential hostel). If this message is read, a “message read” acknowledgment or “receipt” is automatically triggered.

A less frequent but possible use of SPAM involves the use of a mobile phone:

James is running late. He needs to get to the residential hostel office to collect a resident to take her to a meeting. He uses his mobile phone to text the residential hostel office, informing them that they should ring a taxi for the resident if he is not back in 10 minutes.

Figure 9 shows SPAM’s support for this particular interaction. The message is sent via the GSM network from James’s mobile phone to Location B

Figure 8. The process of sending a message between offices using SPAM.

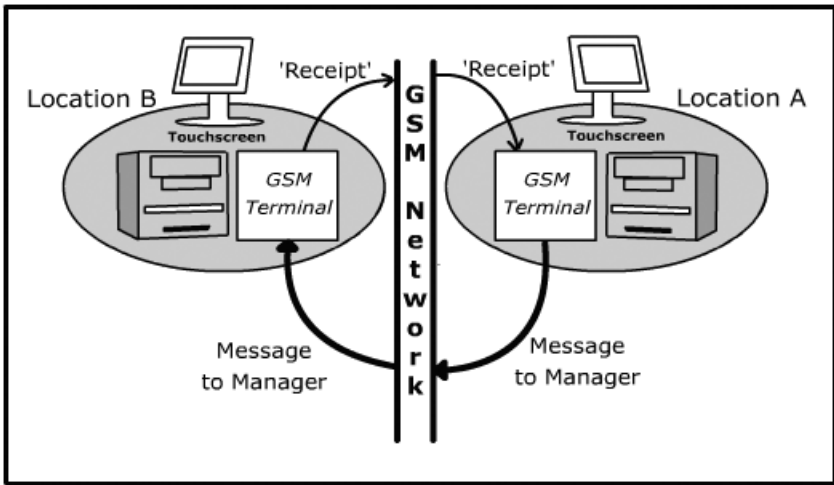
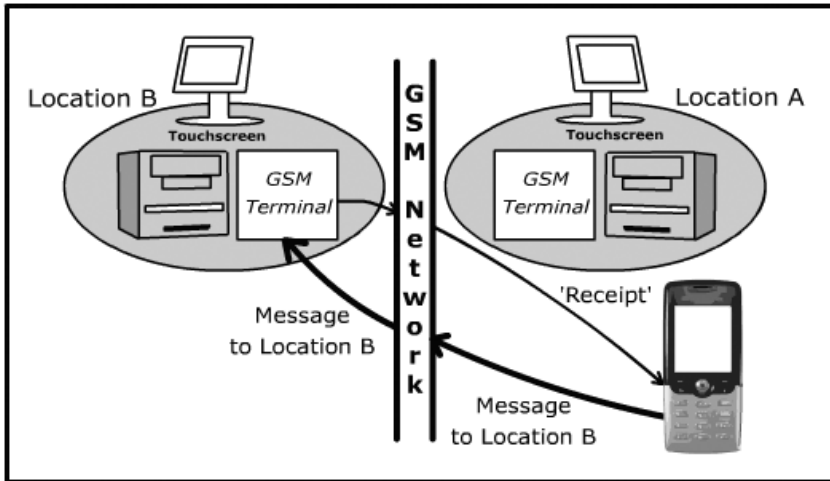


Figure 9. The process of sending a message from a mobile phone using SPAM.



(the staff office at the residential hostel). When the message is read, an acknowledgement, or receipt, is sent to James’s mobile phone.

SPAM also allows messages to be forwarded from the supported housing facility’s (Location A’s) SPAM unit to the unit at the residential hostel (Location B). This is to ensure that important messages are still available to staff

when no staff member is in the office at Location A. This forwarding action only occurs when staff at the supported housing facility set their SPAM unit to an “Away” state before leaving the office.

All messages are logged by simply appending messages to a plain text file stored on each machine at each site. An example of a log of messages generated is shown in Figure 10. This is a mixture of debugging output from communication with the GSM terminal and higher level messages indicating that a message has been sent and received. These logs, with irrelevant information sifted out, are the primary source of data discussed in this article. The technical issues with such filtering are discussed elsewhere (Cheverst, Fitton, Rouncefield, & Graham, 2004).

In Cheverst et al. (2004), we discussed SPAM’s role as a Technology Probe (Hutchinson et al., 2003) within the fabric of this setting. Due to the non-intrusive logging functionality, not immediately apparent to the user, SPAM has acted as a particular kind of probe for “collecting information about use and the users of technology in a real-world setting” (Hutchinson et al., 2003, p. 18).

A distinguishing feature of our deployed technology that we wish to stress in this article is its simplicity and open-endedness: Like Hutchison et al.’s (2003) technology probes, SPAM is open-ended and flexible, and it has simple functionality and limited choices.

Figure 10. Sample of SPAM message log.

```

sender: +44xxxxxxxxxx
date: 02/12/21
time: 16:27:01
message: hi wot time is david calling 2 c hh
--
sender: +44xxxxxxxxxx
date: 02/12/22
time: 21:13:43
message: seting of now see you in 5 J
--
sender: +44xxxxxxxxxx
date: 02/12/23
time: 09:39:52
message: Going to dentist with Paula at 10. Be in touch when i get back
--
sender: +44xxxxxxxxxx
date: 02/12/23
time: 14:39:49
message: Cath have u received your FLAKE    DG
--
sender: +44xxxxxxxxxx
date: 02/12/24
time: 17:34:59
message: It means that Santa is passing over the house and making his way down
to see me = lucky me
--

```

3.3. Analysis of Usage Logs

As the messages sent via SPAM were stored locally on each machine (see the previous discussion), periodically messages were collected to be analyzed through physically visiting the sites and collecting the logs. These site visits (carried out by two of the authors) proved a useful opportunity to informally chat with the members of staff on duty at the time about their experiences with the system. Indeed, it was during one of these site visits that one of the staff members explained how she lived on a rural farm and had texted a message to SPAM one day when she was “snowed in.” The texted message in question turned out to be the “Snow problem please ring” message.

The data logged by the system included a time stamp (date and time), the sender’s phone number, and the message itself (see Figure 10).

Although the system has been used to send thousands of messages, the observations described in the following sections result from the analysis of 360 messages across three samples of the logs presented here: 108 messages sent to one location between October 4, 2002, and November 22, 2003; 88 messages sent to the other location between December 17, 2002, and March 28, 2003; and 164 messages sent between both locations between February 6, 2004, and March 23, 2004 (discussed in Graham, Cheverst, Fitton, & Rouncefield, 2005). Some of the challenges experienced with conducting such analyses are described in Crabtree et al. (2006).

The rationale for this log selection was that we wanted to analyze messages sent shortly after deployment and messages sent after SPAM had been deployed at the setting for some time and become part of the fabric of the workplace, with usage patterns having stabilized. We also wanted to consolidate separate analyses conducted (e.g., Cheverst et al., 2004; Graham, Cheverst, Fitton, & Rouncefield, 2005) with regard to awareness.

A broader set of categories describing patterns of use in the logs is presented in Graham, Cheverst, Fitton, and Rouncefield (2005). This analysis showed that approximately 45% of messages seemed to resonate with awareness (e.g., *Presence*—communication about availability, state, or proximity of self, others, or objects).

Here we present a new theme set that has emerged from a subsequent analysis of the three sets of logs. One author interrogated the logs, creating categories relating to awareness, similar to a process of selective coding (Strauss, 1987). These categories were then iteratively refined, expanded into themes, and verified using two additional authors, one of whom has been involved closely in the deployment and evaluation of SPAM and the other who has knowledge of the SPAM deployment. This analysis showed approximately 22% of the 360 messages sent related to awareness.

3.4. Emergent Usages and Themes Relating to Awareness

This section presents examples of the way the system was used to support awareness. As with Hermes, we present a set of emergent themes, namely, *Making others aware of news*, *Making others aware of a blocked communication channel*, *Setting up availability via another channel*, *Establishing self and others being present*, *Establishing future presence*, and *Establishing mood and personal situation*. Next we describe these themes of use and consider specific examples.

Like Hermes and as previously noted, the themes listed next have emerged not only from analysis of log data but also from a prolonged, personal engagement (Guba & Lincoln, 1989) with the technology placed at the setting which involved visits to the sites (to collect the logs), ethnographic inquiry and the use of Cultural Probes (reported in Crabtree et al., 2003), participatory design workshops (described in Cheverst, Clarke, et al., 2003,) and Graham, Cheverst, & Rouncefield, 2005) and interviews (described in Graham, Cheverst, & Rouncefield, 2005).

Making Others Aware of News

Staff at the two locations made each other aware of information they gained through other resources and information concerning residents' care. In both cases the sender acted like a broadcaster, a kind of proxy, handing on messages and/or information so that others could be aware of them. These messages resonate with Perry, O'Hara, Sellen, Brown, and Harper's (2001) finding concerning the use of technologies by mobile workers: the use of a mobile phone as a "device proxy." They found that in many situations involving mobile workers, a mobile phone was often used to deal with problems of access to people and resources such as a work colleague or fax machine, respectively. Thus a mobile phone could enable access to a secretary or fax machine. In the next example, taking place on a Saturday, SPAM is being used to indicate staff members' proximity to cable television and the radio and to broadcast football scores, making people at the other site aware of a resource that could be exploited.

Location B: "liverpool 10 chealse 0"

Location A: "check your spelling"

Location B: "i have the wireless on, would u like the scores as they come in?"

Location A: "we have got sky [a cable TV channel] on"

Other messages were news broadcasts, making others aware of important events that had happened at one of the locations:

3 bags belonging 2 hp found. no documents relating 2 computer. [name] told me that police have taken threatening letter.

and

[name] frm [place] called back she is calling tomorrow at 10am with [name].

Six messages (2% of the messages analyzed) related to this theme.

Making Others Aware of a Blocked Communication Channel

This theme describes how staff sometimes sent texts that indicated a communication channel was blocked or not available. Staff exchanged some texts that set up a time to communicate via a medium other than SPAM, such as the telephone. In the message “WILL CALL YOU BACK IN ONE HOUR. YOUR PHONE IS CONSTANTLY ENGAGED,” the staff member is indicating that another communication channel, in this case the phone, is blocked. Other examples include “please check your phone is down properly as i can not phone out etc” and “trying 2 send a fax can u let me know when the line is free.”

In these cases the staff member made others aware of a need to be communicated with in a particular way. Thus SPAM was being used to manage the phone or fax. Both of these communication media were *essential* to the staff’s work practice. These findings are similar to Grinter and Eldridge’s (2001) finding that teenagers use texting to coordinate times to communicate via other technologies. An important difference here is that the texts in this study were sent to a *place* with a particular configuration that was known and that these texts, on the whole, were less *particular* to individuals (e.g., please contact house) and were due to the unavailability of, in most cases, the telephone. However, staff did compensate for this anonymity by occasionally texting some form of personal identification (e.g., “Can ynu ring me please i cbn nmt get out yet bd”) as part of the message.

Six messages (2% of the messages analyzed) related to this theme.

Setting Up Availability Via Another Channel

This theme was related closely to the previous theme and often emerged in conjunction with it. Messages were sent that indicated a staff member’s availability (or lack of it) and with them an indication of how the staff member could be reached:

“Snow problem please ring”

“I keep ringing and noaody answers? Can ynu ring me please i cbn nmt get out yet bd” and “any problems contact me on botcherby mobile army own number. ...all quiet here”

Here the staff members were making staff at the location aware of how they could be contacted. Two of these messages were sent from a mobile phone to a SPAM terminal. This suggests that particular channels have particular affordance and that SPAM, although effective for negotiating conversational availability (Nardi, Whittaker, & Bradner, 2000) and making public staff's availability, was less effective for communication involving the exchange of a lot of information.

Five messages (< 2% of the messages analyzed) related to this theme.

Establishing Self and Others Being Present

Numerous issues concerning messaging-based awareness systems can emerge from examining the questions that people ask in their messages. In the course of natural use there were several attempts to establish if others were “at the other end” of the communication channel:

“is there any body there?”

“anyone about”

“is there any body out there?”

Although it would be easy to overlook messages of this kind, these were significant because they showed that SPAM did not directly support certain kinds of awareness (e.g., automatically showing who was present at the other staff office). In this regard, the system did not fully support the notion of visibility discussed by Erickson and Kellogg (2000) with regard to desktop systems supporting collaboration, for example, BABBLE. However, the flexibility provided by the system enabled staff to establish a practice of use to discover such awareness information.

Thirty-eight messages (12% of the messages analyzed) related to this theme.

Establishing Future Presence

Some single texts that were exchanged attempted to establish *future* presence (or absence from) a site:

“If i am not there by 9 30 you might have to ring a taxi as...”

“See you in 5. Put kettle on.”

The former example shows that staff used SPAM to manage contingencies. The latter message shows how staff used SPAM to make others aware of their location, just in time.

Sixteen messages (5% of the messages analyzed) related to this theme.

Establishing Mood and Personal Situation

Several texts involved making others aware of (or inquiring about) the situation “at the other end”, for example “are we having fun children?” These messages related to how busy staff were: “we are 2 busy to play with the spam.” These messages also related events that had recently occurred as well as staff members’ mood and how lonely they were: “[name] has just came back from tesco with the wekly shopping mmmmmm mmmmmm.”

The exchange in the next example, in particular, shows how this staff member established that she was on her own and her mood and state of being alone:

Location B: “hello u 2, everything is fine here, can some l come and meet me at with me being on my own cheers [name] x”,

Location A: “helo to you too! hws life down there in the wulderness???”,

Location B: “VERY QUIET (without NR!!!) fel like going and trashing a room, so it seems more normal!!!!!!”,

Location A: “we are run off our feet here...its all go go go. you could alwys clean [name]s sink out with yer tongue mmmmm”,

Location B: “bluhhh have just chucked up at the thought!! bye 4 now.”

Fifteen messages (5% of the messages analyzed) related to this theme.

4. DISCUSSION

One of the main themes to have arisen from our exploration of awareness issues relating to Hermes and SPAM is the strong personal context given to awareness messages by the situatedness of the displays. The issue of what counts as “appropriate” accuracy when supporting awareness in these systems was another important theme. Still another theme that emerged concerns Hermes’s and SPAM’s connection to other communication technologies and how users rapidly adapted their use of the messaging technologies to fit in with existing communication routines and practices. These practices in-

cluded the expression of mood and feelings: For example, both SPAM and Hermes were used to express being busy. The final main theme regarded the synchronous/asynchronous nature of the two messaging systems. Both systems were, in principle, asynchronous, yet SPAM was generally used in a more synchronous manner than Hermes.

4.1. The Situatedness of Displays

The implication of the situatedness of the displays is a central theme emerging from this work. As Mitchell (2005) eloquently stated,

Literary theorists sometimes speak of text as if it were disembodied, but of course it isn't; it always shows up attached to particular physical objects, in particular spatial contexts, and those contexts-like the contexts of speech-furnish essential components of the meaning. (p. 9)

The situatedness of both the Hermes and SPAM displays provided significant context to the awareness type messages left by the sender of the message. For example, in the case of Hermes, the fact that an office is empty gives significant context to the message "Out to lunch." In this case, given the office is only occupied by one person, the identity of the message is clear and the message naturally provides an explanation for the empty office. The digital affordances of the Hermes door display meant that owners could take steps to ensure that awareness-based messages (e.g., "Gone for coffee") were very secure, but where this impacted on ease of use, security was not considered to be a priority. Indeed, this lack of security led to an interesting appropriation of the system in which some colleagues would set the "temporary" message of a door display owner on his or her behalf. Another factor that arose with Hermes was the differing opinions held by staff regarding whether information on their door displays should be accessible only from the door display itself.

In the closing interviews held between August and September 2004, owners were asked to comment on the following statement: "I would be happy for staff in the department to be able to view my doorplate remotely." The vast majority of owners commented that they would be happy to let a fellow staff member virtually view (i.e., over the intranet) their doorplates if this might save that staff member a wasted trip to their office.

In the case of SPAM, the context provided by the situatedness of the displays was slightly different, not least because each of the two offices containing SPAM units would potentially contain multiple staff members. The situation was further complicated by the fact that staff would move between offices (to offer additional staff support) as required. Consequently, the identity of a message sender was not obvious by virtue of the SPAM display on which it

was received (as was the case with Hermes). For this reason, staff gradually started to develop their own procedures for stating their own identity in a message and the identity of the recipient of the message (stating the identity of the intended recipient also occurred occasionally in Hermes)—although, in the majority of awareness messages sent with both systems, the intended recipient was simply anyone that would naturally read the message on the display (i.e., others in the office in the case of SPAM or visitors to the office in the case of Hermes). In addition, it was possible that residents could briefly enter a staff office, so the SPAM system was designed such that messages would not be overly salient while being displayed but that an incoming message would have a flashing icon to catch the attention of staff in the office at that particular time.

From this discussion we can identify several contextual factors:

- *Identity of message sender*—In the case of Hermes, the door owner, in the case of SPAM one of the staff in the office.
- *Identity of message recipient*—In the case of Hermes a visitor or passerby at the door, in the case of SPAM a member of staff in the office and *not* a resident. Note that in both of these cases, where the identity is not a single individual, additional names or abbreviations need to be given; however, even then the situatedness supplies sufficient context that these can be short or implicit. In many cases the identification of “anyone in this location” seems to be sufficient.
- *Work ecology and spatial layout*—In the case of Hermes, the fact that someone coming to see the office owner must necessarily come to the door forces attention; in the case of SPAM, the layout of the office combined with display attributes ensuring that the message is available to and noticed by only the intended recipients.

As with the last example, all of the aforementioned items impact on

- *Security and privacy*—In the case of Hermes, the acceptability of short messages that could in principle be set by anyone but in practice only by “authorized” people (owner and colleagues). In the case of SPAM, the way the small font size prevents viewing by residents that may wander into an unlocked staff office in a shared space.

4.2. Situatedness and Types of Awareness

In section 1.3, we discussed several kinds of personal awareness messages:

Position: what I am doing / where I am.

Negation: what I am not doing / where I am not.

Explanation: why I am not doing it / why I am not somewhere (often here!)

Examples of all of these have been found in both Hermes and SPAM:

1. What I am doing ...: Examples include an “Out for lunch” or “Lecturing” message left on a Hermes door display or in SPAM the message “i’ll b up in 10 minutes for 20.00 4 the shopping.”
2. What I am *not* doing ...: Examples might include a Hermes owner leaving the message “Fred I’m at WW for lunch” or “in Q at post office” or a SPAM user texting the message “Snow problem please ring.”
3. Why I am not doing it ...: Examples might include a Hermes owner leaving the message “Working at Home today reviewing papers” or a SPAM user sending the message “I am out of the office cleaning 142 as I just had to show somebody round it and it was very dirty. I have my mobile with me.”

Given these categories it is then interesting to observe that the notion of situatedness seems to interact strongly with them. The way the message is situated (e.g., in time) has something to say about the person sending a message and the intended audience of the message.

Awareness Messages of the Form: What I Am Doing ...

In the first category, the location context provided by the situatedness of the display and the “Out for lunch” message becomes a just-in-time explanation of why the person is not in the office. As such, the message makes stronger sense when displayed outside the empty office (something that is apparent to a visitor to the office) rather than, for example, on the secretaries’ home page. With this context the message effectively becomes “To anyone expecting to find me here in my office. ... The reason that I am not here is BECAUSE *I am having lunch* somewhere else.”

The message is relevant to both those with an appointment and those that have visited her office on the off chance of finding the secretary in. It is interesting that this message was often left by a secretary who would have a packed lunch in her office but would (quite reasonably) not wish to be disturbed during that time.

This message would still have significant value if, for example, the message was available over the Web, because it could be used to reflect the fact that the secretary could not be reached by her office phone at that time.

Awareness Messages of the Form: What I Am *Not* Doing ...

In the second category, the location context provided by the situatedness of the display and the “Fred I’m at WW for lunch” message again becomes a just-in-time explanation of why the person is not in the office, but this time the audience is primarily Fred (but the message of course is there for others to see who may be trying to meet the lecturer)—with this context the message effectively becomes “To Fred ... I am *not able to meet you now* in my office BECAUSE I am at the ww having lunch, come and find me?”. The lecturer concerned verified the meaning captured in this particular message during a conversation held with one of the authors within a few weeks of the message being set.

Similarly, the “in Q at post office” message becomes “To those expecting to find me here ... I am *not able to meet you now* in my office BECAUSE I am in Q at post office.”

In SPAM, the message “Snow problem please ring” which was sent by one of the female staff members from home using her own mobile phone and was sent to the office where she was expected to be working (as opposed to the other, sister office, which was the more usual case with SPAM messages) effectively becomes “To those in this office expecting to find me here... the reason that I am *not here working* is BECAUSE I am *blocked in Snow*.” Again, this message makes particular sense given that is received in an office where the context is one of her presence being expected.

Awareness Messages of the Form: Why I Am Not Doing It ...

In the third category, the location context provided by the situatedness of the display and the “Working at Home today reviewing papers” message effectively becomes “To those expecting to find me working here in my office (or expecting to find evidence of me being here today, light on etc.) I am not here BECAUSE I am Working at Home reviewing papers.”

In SPAM the message “Snow problem please ring” that was sent as a text message to the office where she was expected to be had a similar use of context (the audience being those in the office on the same shift), becoming “To those in this office expecting to find me here ... the reason that I am not here yet is *BECAUSE I am blocked in Snow*.”

Relations to Broader Frameworks

In Section 1.3 we noted that the majority of messages for both SPAM and Hermes relate to person and place and so fit poorly into both the Dix (1997) framework and Schmidt and Simone (2000) four awareness levels, both of

which are focused on the relationship between people and work. The focus of the majority of the situated display messages are about availability and location: where, when, and why people are or are not in particular places and how to contact them; that is, the majority of messages are about articulation work (Schmidt & Bannon, 1992)—the coordination and organization that surrounds cooperative activities.

This is partly due to the short length of messages in both SPAM and Hermes; there are better media to talk about work (e-mail, face to face). Instead, these systems are used to talk about the processes (getting in the same place at the same time, or at least getting in contact by other means) that enable you work and to talk about work. Instant messaging (IM), although also allowing protracted conversations, shares this short message length, and in Nardi et al's (2000) study of IM, they found a similar focus on what they termed *outer-action*: the communications outside information exchange but supporting it.

The situatedness of the display also influences its relation to the artifacts of work. In the case of Hermes, the display is *outside* the office, not in the place of work, but in some sense referring to it. In the Dix (1997) framework, it is as if the Hermes displays sits right outside of the triangle ... or at least the place where the triangle "happens." In SPAM the display is physically within the place of work but is *about* people *not being there*. That is, by the combination of placement, purpose, and functionality, these displays suit themselves to articulation work, to coordination about the potential for "doing" work. In contrast, other situated displays are designed to be intimately part of "doing" work, for example, an electronic whiteboard or shared projected desktop.

Situatedness also influences the audience. In the case of SPAM it is not so different from an e-mail except that it is effectively addressed to a role "the person who is in the office." For Hermes, the situation is more complex. The fact that it is a person "at your door" gives them a certain role; in terms of collaborative activity they are likely to be or wish to become engaged in some form of communication or collaboration. For the visitor, they know who the recipient is (the door owner), and so can be directed to the work at hand, but for the door owner, although the recipient/reader is likely to be someone involved in *some* collaborative activity, it is not always clear which one. In some cases the message is explicitly addressed to an expected visitor, although even then it is effectively "overheard" by other visitors (the second part of Schmidt and Simone's, 2000, third level) involved in other collaborative activities. During our analysis of logs, we have seen examples of the rich way in which Hermes owners craft their message so as to convey different "messages" to different visitors—undoubtedly "Marillion!" meant something as a message to particular visitors, but for others it simply meant "not here."

It appears that the general models of awareness need refinement to account for both articulation work, the fact that individuals are involved in

multiple simultaneous collaborations and the need to consider outsider audiences.

4.3. Accuracy and Deliberate Imprecision Relating to Awareness

Both Hermes and SPAM enable users to control the level of preciseness with which they provide others with awareness information. For example, one Hermes owner (a lecturer) requested that their Hermes messages be automatically annotated with a time stamp, whereas other owners did not want this to happen automatically. Our approach here was to enable the owner to specify preference for this particular activity. This issue is particularly interesting given that one of the potentials of digital technology over paper-based approaches (such as sticky notes) is that given computational capabilities the information provided by the digital form could be highly accurate. For example, as mentioned in Section 2.4, a message initially set as “Gone for 5 minutes” could be made to automatically count down. However, this would not reflect the actual imprecision associated with what is generally intended when leaving such a message.

In the case of Hermes, it was interesting to explore the views of owners regarding the difference in precision of awareness messages that they would feel happy having displayed on their door display compared to the information being viewable on a Web page. In general, Hermes users commented that they would provide less precise wording if information were to be available on the Web—one can imagine that the message “Gone to the toilet” makes sense at an office where someone might leave but not on a Web page (do I want my lavatorial habits Web-mine-able?).

So imprecision can certainly be used to protect privacy (e.g., “Gone for lunch” as opposed to “Gone to Joe’s cafe”). The importance of supporting imprecision in awareness systems has been studied previously. For example, work on the Audio Aura system (Mynatt, Back, Want, Baer, & Ellis, 1998) played a sound outside a colleague’s office such that the volume of the sound varied according to the duration that the colleague has been away from his or her office. This approach was deliberately chosen because the imprecision would allay the privacy concerns of colleagues using the system. Similarly, the importance of an abstract (e.g., less accurate) representation of personal context was the focus of the Aroma System (Pederson & Sokoler, 1997). This work considered how the applied degradation to a signal (e.g., an audio or video feed to a person’s current location) could be used to control whether “more or less interpretive efforts are required by the reader of the abstraction” and help protect a user’s privacy in a system supporting awareness of colleagues. It is important to note that both the Hermes and SPAM systems pro-

vide the user with significantly more control over the accuracy of information presented but at the cost of increased effort on behalf of the user to express the level of accuracy required rather than have the system perform this automatically.

The trade-off between awareness of the activities of others and privacy (and between awareness and potential disturbance) is discussed in Hudson and Smith (1996). Examples of this trade-off were certainly evident from observing the usage of both the Hermes and SPAM systems. For example, analyzing the SPAM logs revealed that staff at one location sent several messages to establish if there was anyone at the other. Clearly, if some automatic sensing and relaying of staff's presence at a location had been implemented, then the need for such messages would have been reduced—but with a clear impact on the privacy of those staff having their presence sensed. In this case, as many of the messages were of the form “Is anyone there?” rather than “Is person [X] there?” some privacy could have been maintained by only providing awareness information in an anonymous fashion.

4.4. Awareness and Support for Communication

Both Hermes and SPAM support coordination and cooperation through making awareness information visible. Thus, both systems were part of the cooperative arrangement (Martin, Rouncefield, & Sommerville, 2004) of the workplace.

One particular theme of use that emerged across both systems regarded presence. Approximately 17% of the SPAM messages analyzed concerned presence: *Establishing self and others being present* and *Establishing future presence*.

Based on the findings from the analysis of the SPAM logs we revisited the Hermes logs with regard to the categories found in SPAM.

We found no messages of the kind *Making others aware of news*. Clear examples of the *Making others aware of a blocked communication channel* did exist though: “Away at CORTEX workshop. Back Monday (probably no email in the meantime!)”

Such messages accounted for less than 1% of the messages analyzed. However, one can certainly argue that when the owner of a door display is away from his or her office, there is effectively a blocked communication channel, that is, the unavailability of the owner for face-to-face communication. As mentioned earlier, the majority of Hermes messages were communicating presence-related information, effectively pointing out this blocked communication channel.

Following this, it was not surprising to find that a significant number of messages (9 of the 252 valid messages analyzed, or 4%) related to *Setting up avail-*

Figure 11. Awareness and communication support in Hermes.



ability via another channel. Figure 11 shows one (slightly ironic) message (in this case, a picture) displayed on the door display of a lecturer’s office.

Other Hermes text-based examples include “Reviewing MobileHCI papers, checking e-mail etc.,” “Away from Office Tues & Wed, for Part 1 queries please see Cath in B1a or e-mail me,” and “In London today, back Wednesday. Got mobile if urgent.”

There is a clear similarity between the *Establishing self and others being present* and *Establishing future presence* categories identified in SPAM (see Section 3.4) and the general *Maintaining a sense of presence/reason for absence* category identified in Hermes (see Section 2.4). A reexamination of the Hermes logs with respect to the SPAM categories led to the identification of two subcategories of *Establishing future presence* based on the fact that there was a significant split in the data between messages that provided an explicit reference to the owners return to an office, for example, “At square back in 5 mins” or “Away wed back Thursday am,” and those that provided a more implicit reference to the owners return, for example,

“Gone for coffee”
or “Lecturing.”

Analysis revealed that of the 252 valid messages, 88 (35%) provided an explicit reference to the owners return, whereas 121 (48%) provided an implicit reference to the owner’s return.

Finally, when considering the *Establishing mood and personal situation* category with relation the the Hermes logs, we found that 26 (10%) of the 252 valid messages could clearly be related to this category; examples included pictures (e.g., the picture shown in Figure 11), drawings, and textual messages.

4.5. Synchronous Versus Asynchronous Usages

As summarized in Figure 1, the SPAM system was generally used in a more synchronous manner than Hermes. Examples of dialogues between the two sites appear in Section 3.4 under the subheadings *Making others aware of news* and *establishing mood and personal situation*. In effect, such examples illustrate examples of synchronous IM-type usage.

The SPAM logs also contain examples of messages where a timely response to a given message is explicitly requested, for example, “trying 2 send a fax can u let me know when the line is free,” or at least strongly implied, for example, “simon can you ring please.”

This latter message provides an example where a request is made to communicate via a synchronous communication channel, and as described in the previous section, examples of such requests are also present in the Hermes logs.

5. CONCLUDING REMARKS

In this article we presented a rich set of data relating to issues of awareness captured from the prolonged use of two deployed, situated-display-based messaging systems. These data support many of the previous trade-offs (e.g., awareness and privacy [Hudson & Smith, 1996] and awareness and disruption) discussed in relation to awareness systems in a CSCW context. Furthermore, the data resonate with previous studies of similar technology (e.g., O’Hara et al., 2003). Even the findings that the use of a particular Hermes door display was appropriated such that a lecturer would “update” his colleague’s display and that SPAM was used to establish mood and express emotions resonate with O’Hara et al.’s (2003) finding that a situated display appliance designed to coordinate room bookings in an office environment was appropriated in unexpected ways and even subverted. However, the *particular uses* of these awareness displays could hardly have been predicted with any certainty, even though the Hermes example can be understood as colleagues using each other as proxies, a finding that resonates with a study of mobile workers (Perry et al., 2001). Thus, we believe that to understand and evaluate such new “social technology,” it is important to naturalistically observe practice over time and even be involved in the use of the system.

The Hermes system was, to a large extent, designed to enable an owner to asynchronously send messages (using a variety of methods) to a digital display situated directly outside his or her office for the benefit of visitors to that office by providing awareness information about the “normal” occupant. The owner in this case would either be remote (i.e., not in the office) when sending a message (e.g., via a mobile phone or Web page) or co-located with the dis-

play (e.g., when scribbling an “about to be away” type of message). Alternatively, the SPAM system enabled remote staff to send messages to a generally occupied place, and so in terms of awareness, the typical usage of the system was more that of remote staff members making their status available to those normally at the “SPAM place” (e.g., by entering a short message on the SPAM unit in their staff room to appear on the SPAM unit at the other). In both cases, the point of receipt of awareness is the display location, and its interpretation is highly contextualized, but whose activities are being exposed differs markedly as does the audience.

We are currently developing and evaluating (again through actual deployments over the longer term) a version of the Hermes system that has been tailored for deployment in the home. A small number of initial “formative” deployments have already taken place, and an analysis of use has revealed many similar categories of messages to those encountered with both the Hermes and SPAM deployments, especially those relating to “establishing channels of communication” and “expressions of mood” (Saslis-Lagoudakis, Cheverst, Dix, Fitton, & Rouncefield, 2006).

Although not presenting design guidelines, our experience of the Hermes and SPAM systems leads us to suggest that designers consider the following questions and associated issues:

- *Who can send messages to the display and should access to mechanisms for sending messages be shared?* In Hermes it was ostensibly the owner but the “leave message at door” facility (illustrated in Figure 6) did effectively provide shared access and, as previously described, enabled appropriation to take place. In SPAM, access for sending messages was designed to be shared such that any member of staff located in the staff room (or via their mobile phone) could send a message. However, control mechanisms were in place; for example, the blocking feature that was requested by members of staff would prevent from display messages from a blocked mobile phone. The sharing issue also raises issues of personalization. In Hermes, a large amount of personalization was supported, which afforded high levels of control to the owner of a door display, but in SPAM the highly shared nature of the system meant that such personalization would have been difficult to manage.
- *How public or private is the place where the messages will be displayed, and who are the potential audience/receivers of this information?* This leads to questions of how salient messages should appear in the public setting. For example, in the case of Hermes, the overall design of the screen was such that it would not be overly salient to passersby who were not visiting a particular office. In the case of SPAM, the font size used was specially chosen so that a resident entering a staff room unannounced would not be able to read a message on the screen. It also, crucially, raises issues of control—whether a

received message should be displayed automatically (as in Hermes) or whether some action (e.g., a mouse click) should be required before the message is displayed (as in SPAM). In SPAM, the required mouse click on the READ button acted as a confirmation to the message sender, and again, the implications of providing such a confirmation feature depend strongly on the potential audience, the level of disruption that can be tolerated, and the dependability requirements of the particular workplace.

- *Regarding the creation of messages, what level of expressivity should be supported?* In Hermes users could choose along a spectrum from highly expressive scribbled messages to prescribed (and very quick to select) short messages (e.g., “gone for coffee”). In SPAM, messages were textual, but some members of staff did ask for a range of graphical emoticons to be supported (and quite rightly) to save them some effort when, for example, sending a message expressing their mood. The effort required by the user is also related to this issue of expressivity. The level of expressivity supported also relates to the extent to which users can direct a message to a particular individual or group and the extent to which they can control the accuracy of the information contained in awareness. Such control is crucial if notions of plausible deniability are to be supported. The importance of this has been recognized by other researchers, and Lederer, Hong, Dey, and Landay (2004) included the need for social nuance, including plausible deniability as their fifth potential pitfall for privacy in interactive systems. Associated with this is the issue of how much context (e.g., the time when a message was sent) should appear with a given awareness message. With Hermes, some owners stated that they did not want their messages automatically time stamped, whereas with SPAM received messages were time stamped without complaint. There is a growing literature in issues of user appropriation, but relatively little explicit design guidance. In the case of Hermes, many aspects are deliberately *not interpreted* by the system (text, hand-drawn notes, images), and it is precisely this, combined with the implied audience and context of these situated displays, that allows users to create their own nuanced interpretations.

It is important also to note that although the majority of awareness messages observed were closely related to coordination, many examples arose that (although still pertaining to awareness) were far less coordination oriented in nature (but still part of the rich social context associated with work and the “place” where the messages appeared). For example, despite involving a series of tasks, lecturers would, on occasion, send a (digital) holiday snap to their Hermes display while on holiday, and in the case of SPAM messages such as “Hope you two are having a REALLY busy night and are demented with work!! Its luvverly & peacefull down here thanks :-) [name] x,” clearly

have as much to do with establishing connectedness and notions of playfulness and intimacy as they have to do with coordination. When Nardi et al. (2000) discussed outeraction in IM, they included coordinating other communication media and maintaining social cohesion. Our observations show that this certainly extends beyond IM and that situated displays also allow similar nuanced communication and social intercourse.

NOTES

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