

# At home with the on\_message@home system

Mark Perry and Dorothy Rachovides

School of Information Systems, Computing and Mathematics,  
Brunel University, Kingston Lane, Uxbridge, Middlesex, UB8 3PH, UK  
{mark.perry, dorothy.rachovides}@brunel.ac.uk

## ABSTRACT

We report on the development of a multimodal communications system in the home, involving a networked arrangement of heterogeneous communications technologies centred on shared ‘hub’ displays. The prototype has integrated SMS and MMS messaging, remote and local voice messaging, video messaging, ‘scribble’ notes, camera image downloading, as well as a number of other electronic file formats. We focus on three areas of relevance to the workshop: i) problems in studying and understanding IT for communication in the home environment; ii) problems in empirical studies of the home (data collection and ethical dilemmas); and iii) issues and problems in designing IT for the home environment.

## Author Keywords

Shared displays, home life, communication, user studies, interaction design, multimodal.

## INTRODUCTION

The on\_message@home project is investigating household communication to support the design of a home-based messaging system. The key to this project is the examination of communication/messaging practices and information sharing between members of the family unit within the home. We use the term ‘messaging’ in its broadest sense, to include notes, voice messages, reminders, to-do lists and photographs that have been placed for viewing by others, as well as more formal communications, much as the family refrigerator and other notice boards or corkboards are used for.

The implications of this research have led to the development of a prototype messaging system through which users can remotely ‘post’ messages to situated displays in their homes. We are prototyping a heterogeneous device environment for message posting, with mobile telephones sending SMS (text) and MMS (multimedia) messages, mobile devices connecting over Bluetooth or Wireless LAN (for example, to send photographs or mp3 files), remote web access via a PC over the Internet (to send notes, post interesting documents or other files), and by ‘posting’ messages through local and remote voice-based media (through a dedicated voicemail account). These multimedia messages can then be viewed on wall-mounted, interactive, situated displays that allow family members to view, create, retrieve, sort, discard, move and repurpose the material on them.

This ‘ecology’ of appliances provides a complex platform for use and design, and we have focused our efforts on domestic messaging behaviour and patterns of use around this technology set. Much of this development work is still underway, and we hope to report more on this at the

workshop. Following the theme of the workshop, a number of technical concerns arise out of designing such a system, but our primary concern has been on user interaction with the device set: this has taken two forms. 1) To develop interaction designs and principles for interface design to ensure the technology supports its users’ needs and that it can be used without becoming a demanding cognitive task. 2) To evaluate interaction around the set of devices, for example, enquiring if, why and how the technology changes family roles and relationships, and alters the balance of power within the family; how it may become a focus for certain types of information; how the device is appropriated for playing games and in jokes; whether it improves (or not) family event co-ordination; and how it affects the previously tacit monitoring and policing activities that family members may engage in.

## THE ON\_MESSAGE@HOME SYSTEM IN USE

What makes the home so different from the workplace? It has been argued that the methods that we use to communicate in the workplace are practically no different to those of the workplace and this *is* true to a certain extent. The resources and mechanisms (both social and physical) that we have available to us at work to interpret and act through are the very same ones that we employ at home. What differs is the context of use: the types of activity that users are engaged in and the relationships within the household – these create a related, but distinctly different, set of requirements for home-based IT systems.

In order to explore and illustrate these issues of activity and use, we have developed a number of design scenarios [1]. The following scenario is one that we have formed out of a composite of our current home data (prior to prototype installation), showing how users’ needs might be met and how it could be integrated into their daily lives. An important factor in recognising the way that they were developed is that they were developed out of user needs, and not attempting to simply ‘fit’ a novel technology design to a manufactured set of demands. The use of scenarios also allows us to deploy our anonymised data publicly here, and to link the disparate events that we have documented from all of our households into a rich set of empirically relevant details. The scenario below records a day in the life of a fictitious family from London, which has recently installed the on\_message@home system. The father, Tom is a journalist and the mother Jane is an administrator for a newspaper publisher. They have two children, Kate, 17, at college, and Billy, 10 attending school.

### Passing the time of day

Wednesday @2:15 am: The alarm goes off in Tom and Jane’s bedroom. It is actually the bedroom’s situated PDA

display that Tom set as an alarm the day before. Tom switches the alert off and gets out of bed; the PDA displays the message with the airport cab information. Tom has 45 minutes to get ready. Finally, he gets his bag from his study, checks again he has his tickets and passport, laptop, PDA and the reading material for the plane trip, just to make sure he has covered every aspect of the meeting he is covering about the peace process in the Middle East.

@2:55: The kitchen Screen displays a message and an alert sounds. Time for Tom to stop messing around and get to the door. He dismisses the alert and scribbles a message:

*love you all, will miss you! Have a great day see you on Sunday xxx Dad*

He puts his coat on, switches the TV off, picks up his luggage, and heads to the door. He spots his cab and leaves.

@7:30: Jane is preparing Billy's packed lunch, while grabbing some breakfast at the same time. The kids are having breakfast sat at the table. Jane quickly checks the On\_message screen. She sees the message from Tom, and points it out to the kids, but they have already seen it. There are a few time-dependant message alerts for this morning left by the parents; Billy needs his flute. Jane reminds Kate that she needs to pick Billy from school, and Kate puts an alarm on her phone, to do so. Jane wants to give Kate instructions of what to do to finish off the meal that she has half prepared for them tonight. Kate is in a rush, and has left the room to have a shower. She decides to leave a video message for her. So she goes to the on\_message@home screen and starts recording the message; she chooses this medium because she can show what she wants instead of only describing it. Once done, she sets an alert at 4:00 for Kate to see. Billy promises not to say anything to Kate.

@8:00am: Jane and Billy leave, Jane checks the door PDA on her way out, as she takes her keys from the hook underneath it. She sees the reminder about Billy's flute, and tells him to run to his room and get as she dismisses the reminder and puts her keys in her bag and they are off.

@10:15am: Tom has arrived in Kuwait. He dithers between leaving a silly MMS message of him at customs, but thinks the better of it, as the customs officers look humourless, and leaves a voice message instead. He gives the On\_message number a quick call to say that he is OK for the family to hear when they get home. He reminds them to watch the 6 o'clock news, as he will be reporting live from Kuwait.

@3:50pm: Kate and Billy get home. They see the new message and Kate opens Tom's voice message.

@4:00pm: The kitchen screen displays an alert. She turns to it, knowing that it is probably instructions from Jane about dinner, as she heard her saying something in the background this morning, as she was getting ready. She opens it and finds a video message. She does what her mum has asked her to do and makes sure that Billy is out of the kitchen and watching children's TV, so that she can go and have a look at what she needs to study tonight.

@5:45pm: Jane gets back and Billy plays her the voice message that Tom sent. She is relieved to see Tom's message and remembers to ask Kate if she saw her own

message, which she obviously has, as the food is almost ready. They set the table and get ready to eat while they are waiting to see Tom's report on the 6 o'clock news.

### **So what?**

You might say that this scenario building is just a bit of light fun, but that it doesn't really say anything about the technology itself. There is some merit to this: a scenario-based approach does not really allow access to the real-life complexities encountered when using technology in the wild. Yet it does provoke thinking about the ways that such a technology might be used, and the complex interdependencies that arise when connecting a variety of devices and media together for use in a range of different usage settings, by a range of different types of user, and with a variety of different purposes in mind. There *should* be nothing intrinsically hard to use in such a system, but the reality of this is nothing like so simple, as we have seen in our interaction design and prototype development.

### **STUDYING IT IN THE HOME ENVIRONMENT**

In this section, we cover what we have found to be the important issues in studying and understanding a particular aspect of IT in the home environment (i.e. a multi-modal messaging system). These are many and diverse, and cover technical, interactional and social problems.

When developing for the home, we have faced particular problems in making use of the existing devices in a networked system. In particular, we have faced problems with getting the complex technology to interact with one another: the appliances that we use are often early on in their design lifecycles (for e.g., a GSM terminal/mobile telephone, PDA or Bluetooth), and development software (e.g. powerful and flexible APIs and SDKs), which are simply not available, or require substantial programming effort in order to perform simple actions that are not a part of the basic set of actions expected by their developers. Other devices and software packages are not possible to control through high-level prototyping software, such as Macromedia Director. As a small team of interaction designers and social scientists, this is not a problem trivial. An example of this has been in integrating both MMS and voicemail via a GSM Terminal. This has required extremely low-level Java programming and even electrical engineering skills in rewiring audio circuits. Of course, we can simulate this, but the purpose of the prototype is to investigate real world activities, in as much as we are able. To develop any real understanding of practice, we need to have a semblance of the systems' actual functionality. Perhaps even more frustrating has been the problem of integrating multiple consumer devices onto computers, resulting in software/driver incompatibilities, or when a consumer technology manufacturer has actually prohibited certain uses of their device, denying us the opportunity to use it flexibly – compounded by not putting this information in their pre or post-sale documentation.

But to place the problematic technological issues at the core of system development would be a mistake. The key concerns that we face in developing an effective design, as might be expected from an interaction-oriented project,

centre around social issues. This is not to say that they are ‘problems’ as such, but they are aspects that may be problematic for the household to resolve, and may impact on the acceptance of the technology in the long run (or even rejecting an initial deployment of the prototype). As we have implied earlier, just because a technology is simple and does not greatly alter the functional activities of the household it can still have the potential for social disruption. This could occur through subtle changes to family roles (e.g. by distributing the role of the information gatekeeper) and relationships (e.g. enhancing displays of affection by allowing remote others to interact with those at home, and enriching the methods they can use). Some of these changes have the potential to shift the balance of power within the family or household. There is also a potential that explicit and publicly visible representation of communication could affect the previously tacit information monitoring and policing activities that adult or controlling family members may engage in. This is not to say that any of these resulting behavioural changes is negative, or that they are undesirable result of the study – we are as interested in understanding the transformative effects of networked communications technology at home as we are in developing useful and usable designs. By transforming activity, technology can provide fascinating insights about how family relationships operate, much as an ethnomethodological breaching experiment [2] can tell us about the maintenance of social order by breaching the commonly-held-to-be-true ‘rules’ of the home.

Another matter of concern to the households being investigated, and this may relate to the research study and any commercialised design, lies in privacy, and access to content. It is perhaps of greater concern to households for the prototype, who will have opened access to the information to researchers. This is partly that they have issues of embarrassment in opening up their private worlds to researchers, but also because this technology may allow access to sensitive information that could be useful to burglars or nefarious others (e.g. phone numbers, children’s photographs, calendar information about when they might be on holiday, information that might be used against them in court). Even the integration of a web camera in the system to record video messages has given rise to questions about who might be able to access a video stream remotely (thieves, paedophiles or stalkers?). These are serious issues to resolve if we are to ensure this technology has any hope of being installed. It must be remembered in these circumstances that household users may not be fully aware of the potential of the technology (which might be very limited in practice) in a way that technology developers would scoff at. Yet to get such a technology set adopted into the home will require these concerns to be ameliorated. Indeed, some of these concerns may be grounded in a very real danger, and they are not ones that we should attempt to explain away or deny.

## **EMPIRICAL STUDIES IN THE HOME**

In this section, we examine data collection methods and the ethical dilemmas of data collection within a domestic or family environment.

The initial pre-deployment study was carried out over multiple visits, involving interviews with household members, asking about their communication activities. We asked them to make a photo-diary of all “messages” made, whether written notes, or objects that were put in a particular place for someone else to see. What has to be recognised is the difficulty in gaining access to the homes. Recruitment information was circulated via mailing lists to members of staff and students in our department, approximately 500 people, and was also forwarded to other lists by some of them giving an approximate total of 700. Although some respondents were interested and got in touch with us, when discussing it with members of their home they had to pull out. A lot of time was spent in negotiations before finalising the first visit, with one case even with a visit set-up, the family pulled out. Participants who were originally hesitant, admitted that they felt uncomfortable with the idea of being asked about how they do things at home, apprehensive that some questions would be too personal and intrusive. Usually halfway through the first visit, participants admitted that they had originally been apprehensive, but relaxed when they realised the actual nature of the study. This helped data collection, as a social relationship was built up with the participants, and subsequent visits were always much easier.

Another of the concerns that we were particularly worried about was the involvement of minors in the study. Given their heavy use of existing communications technologies, they were likely to be important users of the technology, yet this raised questions as to investigating a) what and to whom they were sending messages, b) how we might question them about messages that were interesting, but perhaps sensitive, especially when their parents might not approve of this ‘illicit’ content, and c) how we might question those children about their activities without putting ourselves in a position of potential accusations about our probity and to reassure potential families that we have responsible motives, whilst at the same time, collecting interesting and useful data about messaging activity. Whilst these are clearly important issues, we have yet to encounter them in the main part (although to an extent c) is still relevant), as we have not evaluated the prototype in homes yet. However, this does have serious implications for us, and it may help to use diary information that is not monitored directly by the parents, although this will necessarily require their consent.

An unexpected element of the study was in the researchers being invited to eat with the households under study, giving a view into family life that was routine, yet central to communication and later contextualisation of the data set. This was not practical with all of the households, and not all of these households had regular meals, but it allowed access communication first-hand on an informal basis.

## DESIGNING NETWORKED IT FOR THE HOME

In this section, we cover issues and problems in designing IT for the home environment. These are both interactional (problematic relationships arising between the interface and the particular context of the home), and social (problematic relationships arising from the provision and increased visibility of information within the home). Of course, we recognise that these may be interrelated with one another. We do not necessarily provide solutions here, but suggest where problems lie that may require attention in design.

### Interactional issues

It needs to be remembered at all times that any home-based system is accessible, and may be utilised, by people of different ages, physical and cognitive abilities, and even physical stature. Designing such systems could be enormously problematic, in providing a high enough level of functionality to support complex use, through simple actions at the interface. Here, the information appliance design principle of 'single in function, open in use' may be of benefit, allowing simple and non-technical interactions to be built up into patterns and contexts of use that support more sophisticated activities.

There are other appliance issues in networked systems of devices. To give the user a consistent 'feel' across the device range, at some level, there should be consistency across input types, and consistency across the media displayed. This has implications for the usability of the system and for the ways that information from the various devices can be combined and integrated together.

In any information-limited system (either storage and/or screen real-estate) that has a shared interface, and for which the content is which is not 'owned' by someone, there is the potential for a 'tragedy of the commons' effect. There are clearly information management issues in the design of any such system, to ensure that a shared screen resource does not become clogged with visual material and overloaded to the point that it is unusable. There are potential ways to resolve these, such as supporting the use of social protocols to ensure responsible action, or to automate an information archival process, but this should be used with caution, as automation may not fit with existing patterns of home life.

Finally, there is an important role for the representation of metadata in contextualising information in the media used. For example, when the on\_message system receives a SMS text message, the message is visibly 'stamped' with information on the sender (as a photograph and/or a phone number), the time received, and the type of message that it is (SMS). All of this information allows the readers of that content to interpret it within a context: is it still temporally relevant? Is it of concern to them? Should they treat it as a request for action? Should they reply to the sender?

### Social issues

By making information that would otherwise be held in physical (and consequently, access-limited) repositories, we open this information up to more public access than it would previously have been. Within the home, examples of this includes making a child's private materials visible to their

parents, when the child may or may not be fully aware of this. Indeed, it is the nature of much IT technology that this access to content is *not* fully transparent. As designers, we do need to ensure that where information content is, or will be made publicly available from the networked devices, this should be visible at the point of creation, and users should have the ability to delete content. One way to achieve this (and which is the approach that we have selected) is to open up *all* content to access by *all* devices within the home – minimising the risk of this confusion.

Another concern about the social effects of networked IT in the home that concerns us is the potential impact of the technology in facilitating antisocial behaviour, which for e.g. in the family home could involve bullying. These concerns give rise to management issues, not necessarily of content control, but of content management: who can access and remove information held on the system. Of course, this is similar to a paper-based system, many of which we have seen in the homes we visited. But there is a difference here, in that electronic systems can be more invisible to external monitoring and 'social' policing, and thus are open to what may be deemed as less responsible patterns of use.

The home is not a 'blank canvas' that researchers can place information or technology in without regard for its residents' preferences. There is a real issue here in where to place screens (or other hardware), and homeowners may have strong feelings about where research prototypes or eventual technology might be placed. This may be based on an aesthetic preference, or a pragmatic one in which they do not wish for large objects to be drilled into their walls. In our work, this has led to limits being placed on screen size and display placement, although it remains to be seen whether this is a long term issue: it may be that the perceived value/utility of an eventual system, based on the householders' further experience of the system will lead to accommodation in this respect.

Finally, there is an important point to be made about aesthetics in the home: what is an aesthetic experience (visually, or through the nature of the device interaction) can clash with what we take to be the criteria associated with usability. We see this in the design of devices such as the mobile telephone and iPod, where the aesthetic of the device form and its interaction methods may override what is regarded as a suboptimal interaction design.

### ACKNOWLEDGMENTS

This work was funded by Microsoft Research ERO. We would especially like to thank Alex Taylor, Kenton O'Hara, Abi Sellen, Shahram Izadi, Tim Regan, Richard Harper and Marco Combetto for their help in informing and conducting this research.

### REFERENCES

1. Carroll, J.M. (2000) *Making Use: Scenario-Based Design of Human-Computer Interactions*. Cambridge, MA: MIT Press.
2. Garfinkel, H. (1967) *Studies in ethnomethodology*. Englewood Cliffs NJ: Prentice-Hall.