Facilitating purposeful adoption and diffusion of ubiquitous communication technologies in domestic environments

John V H Bonner
Dept of Informatics
School of Computing and Engineering
Huddersfield University
j.v.bonner@hud.ac.uk

Introduction

This paper puts forward some suggestions for a more purposeful approach to the design of emerging and future ubiquitous communication technologies. The first part highlights a number of constraining factors that affect adoption and diffusion of domestic communication technology innovation. Within this context, I then draw attention to some ethical and commercial imperatives we should also consider to shape these technologies. The need for a more purposeful approach is inspired by Nardi and O'Day (1999) who state '*The issue is not whether we will use technologies, but which we will choose and whether we will use them well. The challenge now is to introduce some critical sensibilities into our evaluation and use of technology, and beyond that, to make a real impact on the kinds of technology that will be available to us in the future'*. This position paper, therefore, addresses the difficult issue of making a 'real impact' and provides some outline suggestions on how we might go about achieving this.

Adopting communication technology

Researchers have argued that an important prerequisite to the development of new domestic technologies is the need for a contextually rich understanding of domestic life to provide parameters for design activity (Blythe & Monk, 2002; Crabtree & Rodden, 2004; Hughes, O'Brien, Rodden, Rouncefield, & Viller, 2000) or more specifically to provide guidance on new technologies for existing communication methods (Crabtree, Hemmings, & Rodden, 2003) Research groups have also set up smart homes (Taylor et al., 2006) in order to explore more practically the potential implications of new communication technologies. The motivations for such studies are usually to identify new communication media, to make predictions about their social effect, or to explore how these new technologies can enrich domestic communication. The emphasis of this work is on new communication technologies or the augmentation of existing ones. In this paper, a more historical and analytical approach is taken by identifying common adoption factors between traditional, emerging and future communication technologies.

A small number of social science studies addressing domestic communication technologies at different stages of maturity were selected. These were analysed to detect common threads of usage and thus adoption behaviour that persisted across the different communication devices. The communication technologies selected were: the traditional telephone (Anderson, McWilliam, Lacohee, Clucas, & Gershuny, 1999; Kline, 2003); emerging technologies such as domestic networking (Grinter & Edwards, 2005) and Instant Messaging (IM) (Grinter & Palen, 2002); and finally novel prototype technologies such as interactive message and video communication devices (Hutchinson et al., 2003) and 'media spaces' (Hindus, Mainwaring, Leduc, HagstrÖm, & Bayley, 2001)

The first theme identified was the importance of a communication technology to fit in with natural domestic rhythms. Kline (2003) describes how farming communities in Mid-West America, despite dissuasion by the local telephone in the 1920's, used their party-line to eavesdrop on local conversations in the local community. The users were resistant to change this practice as it formed a natural extension to gossiping. Other studies reinforce this sentiment of rhythm, but express it quite differently. Anderson, McWilliam et al. (1999) demonstrate the importance of having an awareness of domestic rhythms in other homes. This remote awareness is used to avoid intrusion by deliberately avoiding calls at inconvenient times, such as meal times or when the caller knows the recipient will be watching a particular programme on television. This shared understanding of rhythm can be quite subtle and the authors explain how a woman knows her

friends would never call her during ‘Eastenders’. The popularity of IM amongst teenagers can also be attributed, in part, to its ability to fit naturally into domestic rhythms by being a silent medium, it does not disturb or bring attention to itself and keeps below the ‘horizon of notice’ at home. But also importantly it also provides a *supplementary opportunity* by extending school conversations in the home. Teenagers were found to be very coy about their use of IM (Grinter & Palen, 2002). The technology also proved beneficial in simplifying the usual complex process of negotiating with each other and their respective parents to arrange outings and parties again another example of a supplementary opportunity. In the interactive message board study, the researchers ensured that the devices were placed in areas of high traffic to increase casual and serendipitous use. Therefore, we can see good evidence that new technologies should not significantly disturb domestic rhythms but can provide opportunities to slowly transform them.

Controlling communication is also an important factor for successful adoption whether through deferment, non-use, or level of privacy. Gate-keeping is a common control activity, for example by allocating a member of the family to screen phone calls or, in the home network study (Grinter & Edwards, 2005) a member of the family assumes the ‘network manager’ role by resolving network problems for the family. Gate-keeping activity is also evident with IM, which allows multiple conversations at the same time for both public and private conversations. Teenagers become very adept at managing a series of private and public conversations. In contrast, the interactive message board (a device that provides asynchronous text and pictorial images between family groups), (Hutchinson et al., 2003) lacked gate-keeping control because it was not possible to edit a message before it is published or to control the recipient of a message; families wanted to know with whom they were communicating, nevertheless, it proved successful in supporting coordination activity between different family locations which may suggest a supplementary opportunity.

Inherent in asynchronous communication technologies is some degree of obligation to reply or respond. That is, an expectation that communication will be reciprocated. Most studies highlighted how women feel a greater sense of obligation to keep in touch with friends and family, whether this is a regular call to a close family member or just to keep in touch with a friend. Again, a common thread between these studies was how different communication technologies were able to manage obligation. Anderson et al (1999) describes how the phone can be used to defer an obligation through the use of ‘pseudo-maintenance’ calls. Calls are made when the caller knows the recipient is out and can leave a message thus helping to sustain the relationship. IM also encourages a sense of obligation to engage in on-line communication as non-involvement could result in exclusion from social groups. The study explains how teenagers go to great lengths to keep within the rules of engagement. In the study by (Hindus et al., 2001), they explore the potential acceptability of a small portable device which could transmit a simple tactile or audio signal between two individuals so one individual can let the other know they are thinking about them. Despite the simplicity of the design and its emotional and intimate purpose, obligation to respond without due control, was raised as a concern.

This cursory review hints at how new communication devices need to fit a complex array of challenging demands: they must be both private and public, while also being manageable within evolving and disparate domestic rhythms. Successful new communication technologies must support this underlying communication structure, which is made up of a range of ‘disparate concerns’ (Crabtree & Rodden, 2004) of social behaviour. This structure forms the identity of a domestic group and new technologies will only be accepted if these structures are not initially disrupted or threatened. Supporting evidence for this argument can be found with domestic labour saving technologies. Labour saving devices dramatically changed domestic labour but did reduce the overall hours spend on house work as this was displaced by other domestic routines. Technology changed the character of domestic activity but not the underlying family values (Cowan, 1999). However, adoption can be increased if the technology provides these supplementing opportunities. This may be a new device for keeping in touch, as in the case of the American farmers or helping teenagers continue conversation outside of school. New technologies usually supplement rather than substitute real activities (Woolgar, 2002).

Evidence from these studies provides some grounds to argue that successful new communication technologies must be sympathetic towards domestic rhythm, control and obligation. Technologies that

undermine these underlying domestic structures are unlikely to be adopted. A study by Francil, Rudman et al. (1991) illustrates this argument further. In this study the researchers attempted to support the adoption of a very innovative multimedia communication system in a large IT organisation. Considerable effort was required to articulate to users how they might use this new system. Because it was so radical it required the organisation to form different organisational tasks in order to be evaluated effectively. However, over time new communication opportunities do evolve and instinctively new social purposes are found (Dryer, Eisback, & Ark, 1999) This may, in turn, displace other social activities. Manufacturers quickly recognise these opportunities and provide new products and features to fulfil these social needs. Through this, a process of co-construction occurs (MacKenzie & Wajcman, 1999; Oudshoorn & Pinch, 2003). Thus, change and innovation occurs in spaces where communication technologies provide supplementing opportunities.

Diffusing communication technology

So far I have identified some common adoption sensitivities across different communication technologies which, in the short term, only permit small incremental changes to social practice. It is probably no coincidence that manufacturers of communication technologies also adopt incremental innovation strategies, the telephone, for example, took around 60-80 years to become common place. This is because this approach offers low risk, does not suffer from misunderstandings of misconception, relies on conventional routes to market, and is generally more quantifiable in terms of usability, and adoption and diffusion behaviour is predictable.

However, if the future favours the use of ubiquitous computing to mediate communication, then this causes problems with this incremental model. A ubiquitous environment would require significant upheaval to the domestic environment. The difficulty lies, again, in the process of adoption; a domestic environment can either be ubiquitous or a collection of technological devices that form part of a networking infrastructure but it can not be semi-ubiquitous. Imagine the following scenario. A seamless communication domestic environment is constructed where notes of paper, mobile phones, interactive notice boards, a home PC and television all integrate. Assume also, it would be possible to design these myriad of devices to overcome the adoption issues already raised above. It would be very unlikely all these devices would be purchased at once, practically, ubiquitous devices would be accumulated slowly over a period of time. Therefore each device would require stand-alone functionality, common networking protocols while also being configurable with other devices. It's also highly unlikely that this diverse range of devices would be manufactured by a single manufacture. This suggests that ubiquitous communication devices will still evolve slowly by growing out of existing technologies and at some distant point they may amalgamate and be recognised as ubiquitous.

Influencing adoption and diffusion

In this paper I have argued that radical innovative products that provide new (disruptive) ways to communicate are unlikely to be adopted. Therefore, we need to move beyond the seduction and spectacle of novel devices. Furthermore, new communication devices, particularly of a ubiquitous sort, will not emerge in unforeseen ways but will evolve through small imperceptible innovative steps. This comparative analysis of a small number of studies has illustrated that families are implicitly aware and sensitive towards maintaining their own communication practice. However, there is also evidence that families are very willing to seize new supplementing opportunities to reinforce personal communication preferences. Thus discussions about the social and ethical implications of dazzling new communication technologies (Bohn, Coroam?, Langheinrich, Mattern, & Rohs, 2004) are probably premature. If this is the case, attention needs to be drawn away from conceptual product development towards creative solutions that are firmly grounded within the commercial constraints that the communication industry faces. (Although, it could also equally be argued that 'blue-sky' thinking widens our future options.) Nonetheless, it is likely that ubiquitous communication devices will evolve from elaborations of existing communication devices rather than emerge as completely novel and distinct devices. One key enabling device is the mobile phone which is beginning to communicate with a diverse range of domestic items - see Roberts and Wilson (2007) for examples. This requires researchers to form relationships with a wide range of manufacturing and service organisations. To do this we need more 'bridging' studies between academia and industry (which are likely

to be beyond the computing and communication industries) to understand the different cultural viewpoints each holds (Green, Harper, Murtagh, & Cooper, 2001). We also need to place more weight on important economic and political factors that impact on product development (Stewart & Williams, 1998) as these factors critically determine the future communication technologies.

Environmental and ethical factors are also a further consideration. We need to devise new technologies to help improve sustainability and reinforce social cohesion. To date, there has been very little research on interaction design issues that might influence communication content. Research has focussed on alternative, mixed and novel interaction styles of these mediating technologies, but little has been achieved in exploring ways of enhancing the value or essence of domestic communication. No research was found specifically examining moral issues around this topic, although some work has been carried out in commercial environments (Drake, Yuthas, & Dillard, 2000) They found that IT has both detrimental and positive possibilities for moral dialogue and provide a framework for this form of discourse. Domestic environments, in contrast, provide more opportunities for spontaneous dialogue than commercial environments and have less formal communication structures and so significant work is required on exploring social and moral practices and constraints.

One of the most radical effects of communication technology is to enable communities to live further apart which creates a greater demand for transport systems (Thackara, 2005), particularly cars. Due to the threat of depleting global resources, there is perhaps more of a need to look closely at the fundamental purpose of communication technologies in terms of environmental and ethical considerations. Do we need yet more communication technology purely for consumption or pleasure? How do we create communication infrastructures that improve social presence, social partnerships and services which directly reduce the need for travel?

To conclude, I have suggested some ‘critical sensibilities’ that Nardi and O’Day (1999) allude to at the beginning of this paper to provide a more purposeful direction for future communication technologies in the home. More research is required to identify the underlying adoption characteristics which appear to be common across existing, emerging and future technologies. There is as much to be learnt from historical accounts as there is from prototype testing of new technologies. The focus of our concern should be at the incremental development level of emerging services and products, as ubiquitous communication devices are likely to evolve from the edges of these existing products. But, at the same time, more attention needs to be placed on commercial, environmental as well as ethical and moral choices to ensure that we do have a real impact on the adoption and diffusion of future communication technologies.

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