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**Abstract:** This paper presents suggestions for a more pragmatic approach to the design of emerging and future domestic communication technologies, particularly technologies destined for the home that maybe deemed 'ubiquitous'. This is achieved through two critical reviews of a small number of social studies related to the design and use of existing and emerging communication technologies. The first review explores how existing, recent and emerging technologies are adopted within the domestic home and explores how social patterns dictate adoption. The second review draws more broadly on research activity related to the design and development of ubiquitous technologies for everyday life and what lessons can be learnt from them. Together, these two reviews suggest novel communication technology adoption will evolve through small imperceptible steps from the edges of existing products and services; therefore design research needs to be more aligned to this approach. To make any real impact and influence, research activity needs to move away from attempts to deliver ubiquity in the home and place more emphasis at the pragmatic, incremental level of emerging communication services and products.

Suggested Reviewers:

Opposed Reviewers:



Revision notes for editors and reviewers

Thank you for the comments and suggestions for the paper. I have included all the suggestions from reviewer #2. Some of the text has been re-organised to improve clarity of the argument and additional references have been added. Apologies but I've sent this after sending the manuscript – sorry should have read all the instructions first.

John Bonner

## Adding critical sensibilities to domestic communication technologies

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### Abstract

This paper presents suggestions for a more pragmatic approach to the design of emerging and future domestic communication technologies, particularly technologies destined for the home that maybe deemed 'ubiquitous'. This is achieved through two critical reviews of a small number of social studies related to the design and use of existing and emerging communication technologies. The first review explores how existing, recent and emerging technologies are adopted within the domestic home and explores how social patterns dictate adoption. The second review draws more broadly on research activity related to the design and development of ubiquitous technologies for everyday life and what lessons can be learnt from them. Together, these two reviews suggest novel communication technology adoption will evolve through small imperceptible steps from the edges of existing products and services; therefore design research needs to be more aligned to this approach. To make any real impact and influence, research activity needs to move away from attempts to deliver ubiquity in the home and place more emphasis at the pragmatic, incremental level of emerging communication services and products.

### Keywords

Domestic communication technologies, ubiquitous computing

### 1 Introduction

This paper presents suggestions for a more pragmatic approach to the design of emerging and future domestic communication technologies, particularly technologies destined for the home that maybe deemed 'ubiquitous'. Mark Weiser is generally recognised as defining the term 'ubiquitous computing' and putting a case forward for computing devices that will disappear into everyday life thus rendering them invisible. He was concerned that non-technical aspects of his vision, the social and cultural aspects needed to be key determinants in design and development thinking. Weiser's vision (1991) has precipitated considerable research with the production of a wide variety of prototypical devices. With over 15 years of development activity since the inception of this concept, it is now possible to reflect on our current understanding and use of ubiquitous computing within the context of a domestic environment and be able to suggest how to build future domestic communication technologies.

Within this context, this paper proposes a broader socio-technical approach in order to purposefully shape these technologies. Nardi and O'Day (1999 p.22) 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 paper continues this debate by identifying what these critical sensibilities might be in a more pragmatic sense by offering a considered approach to the design and adoption of ubiquitous communication technologies within the home. This is

1 achieved through a critical review of a number of social studies related to the innovation and  
2 adoption behaviour of existing and emerging communication technologies. The first short  
3 review explores how existing, recent and emerging technologies are adopted within the  
4 domestic home and explores how social patterns help dictate adoption of new technologies.  
5 The second section draws more broadly on research activity related to the design and  
6 development of ubiquitous technologies for everyday life and what lessons can be learnt from  
7 them. These two reviews help identify where research into domestic communication  
8 technologies is best placed so that we can purposefully shape these new technologies.  
9 Whilst domestic environments do not evolve as individual islands, they have very distinct  
10 characteristics from other communication environments such as business or public places;  
11 essentially homes are, or can be, intimate and private spaces which are keenly protected.  
12 Homes allow for individual and group privacy while also being receptive to external social  
13 interactions. New communication technologies continually redefine these sensitive  
14 boundaries between social and private spaces. Therefore we need to understand these  
15 changing boundaries in much the same way as they are understood within business and  
16 public environments in order to shape these technologies for the future.

## 17 18 2 Domestic communication technologies in the home

19 A small number of social science studies addressing domestic communication technologies  
20 at different stages of maturity were selected. These were analysed to detect common  
21 threads of usage and thus adoption behaviour that persisted across the different  
22 communication devices. The technologies selected were: the traditional telephone  
23 (Anderson et al., 1999; Kline 2003); emerging technologies such as domestic networking  
24 (Grinter and Edwards, 2005) and Instant Messaging (IM) (Diane et al., 2002; Grinter and  
25 Palen, 2002); and finally novel prototype technologies such as interactive message and video  
26 communication devices providing asynchronous text and pictorial images between family  
27 groups (Hutchinson et al., 2003) and 'media spaces' (Hindus et al., 2001)

29 The first identified theme that consistently cut across all the identified technologies was the  
30 need for any given technology to fit in with natural domestic rhythms. Work patterns,  
31 schooling, preparing and eating meals and relationships with neighbours are examples of  
32 important rhythms that mould domestic routine. Technology plays its part in influencing this  
33 process. Kline (2003) describes how farming communities in Mid-West America, despite  
34 dissuasion by the local telephone in the 1920's, used their party-lines to eavesdrop on  
35 conversations in the local community. Part of the farming community's natural rhythm was to  
36 meet in the centre of the town to share and trade gossip. The introduction of the telephone  
37 extended this gossiping habit into the home as privacy was not initially regarded as an  
38 essential feature. In fact, users were resistant to using the telephone other than in an open  
39 and public way. Despite various attempts by the telephone company to stop party-line  
40 conversations, many farming communities persisted in using the telephone in this way. Other  
41 studies reinforce this sentiment of maintaining rhythm, but express it quite differently.  
42 Anderson et al. (1999) demonstrate how families can have an affinity with domestic rhythms  
43 in other homes. This remote awareness is used to avoid intrusion by deliberately avoiding  
44 calls at inconvenient times, such as meal times or when the caller knows the recipient will be  
45 watching a particular television programme. This shared understanding of rhythm can be  
46 quite subtle and the authors explain how people know an incoming call would not be for them  
47 if made during their favourite 'soap' because friends would never call at this time.

49 The popularity of IM amongst teenagers can also be attributed, in part, to its ability to fit  
50 naturally into domestic rhythms by being a silent medium, it does not disturb or bring attention  
51 to itself and keeps below the 'horizon of notice' at home. IM provides an opportunity to  
52 extend school conversations or to relieve boredom (Diane et al., 2002). During interviews,  
53 teenagers were found to be very coy about their use of IM because it provided extended  
54 opportunities for class-room banter without disturbing existing domestic rhythms (Grinter and  
55 Palen, 2002). The technology also proved beneficial in simplifying the usual complex process  
56 of negotiating with friends and parents in making arrangements for outings and parties. In  
57 the interactive message board study (Hutchinson et al., 2003) the researchers ensured that  
58 the devices were placed in areas of high traffic to increase casual and serendipitous use thus  
59 exploiting normal domestic rhythm.  
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1 Being able to control a communication medium is also an important factor for successful  
2 adoption whether through deferment, non-use, or level of privacy. Gate-keeping is a common  
3 control activity, for example by allocating a member of the family to screen phone calls or, in  
4 the home network study (Grinter and Edwards, 2005), a member of the family assumes role  
5 as 'network manager'. Gate-keeping activity is also evident with IM, which allows multiple  
6 conversations at the same time for both public and private conversations. Teenagers become  
7 very adept at managing a series of private and public conversations. In contrast, the  
8 interactive message board (Hutchinson et al., 2003) lacked gate-keeping control because it  
9 was not possible to edit a message before it is published or to control the recipient of a  
10 message; families wanted to know with whom they were communicating, nevertheless, it  
11 proved successful in supporting coordination activity between different family locations which  
12 may suggest this form of technology could open up new forms of communication channels.

13  
14 Inherent in asynchronous communication technologies is some degree of obligation to reply  
15 or respond. That is, an expectation that communication will be reciprocated. Some studies  
16 highlighted how women feel a greater sense of obligation to keep in touch with friends and  
17 family, whether this is a regular call to a close family member or just to keep in touch with a  
18 friend. Again, a common theme between these studies was how different communication  
19 technologies were able to manage obligation. Anderson et al. (1999) describes how the  
20 phone can be used to defer an obligation through the use of 'pseudo-maintenance' calls.  
21 Calls are made when the caller knows the recipient is out and can leave a message thus  
22 helping to sustain the relationship. IM also encourages a sense of obligation to engage in on-  
23 line communication as non-involvement could result in exclusion from social groups. The  
24 study explains how teenagers go to great lengths to keep within the social expectations of  
25 their peer group. IM also provides a powerful benefit of enabling control through concurrently  
26 maintaining, sometimes conflicting, expectations between family and friends. Hindus et al.,  
27 (2001) explored the potential acceptability of a small portable device which could transmit a  
28 simple tactile or audio signal between two individuals so one individual can let the other know  
29 they are thinking about them. Despite the simplicity of the design and its emotional and  
30 intimate purpose, obligation to respond without due control, was raised as a concern,  
31 reinforcing the importance of personal control.

32  
33 By examining established communication technologies like the telephone, recently adopted or  
34 emergent, these studies reveal all of them need to be resonant with domestic rhythm, control  
35 and obligation. New devices need to fit complex and sometimes conflicting demands: they  
36 must be both private and public, while also being manageable within evolving 'disparate  
37 concerns' within the family (Crabtree and Rodden, 2004). New technologies will only be  
38 accepted if they are not perceived as being overtly disruptive. Although over time as new or  
39 variant uses may be found, alternative behaviour may emerge but only if it does not threaten  
40 underlying family values. Labour saving devices in the early 20<sup>th</sup> century, for example,  
41 dramatically changed domestic labour but did not reduce the overall hours spent on house  
42 work as this was replaced by other domestic routines (Cowan, 1999).

43  
44 Nevertheless, taking a longer term perspective, new communication opportunities do evolve  
45 and instinctively new social purposes are found (Dryer et al., 1999). This can be a new  
46 device for keeping in touch or gossiping, as in the case of the introduction of the telephone  
47 for American farmers or in helping teenagers to continue conversations outside of school.  
48 New technologies supplement rather than substitute activities (Woolgar, 2002). By using a  
49 longer time frame, a process of co-construction can be observed (MacKenzie and Wajcman,  
50 1999) where key social groups play an important role in the design and consumption of  
51 technology (Oudshoorn and Pinch, 2003; Pinch and Bijker, 1984). Through the social  
52 construction of technology, social constructivists argue that social groups have an active  
53 involvement in determining and defining the criteria for technological development and  
54 adoption. Distinctions between groups are based on their shared or diverging interpretations  
55 of a given technology and usually include user and producer groups. Studies on the  
56 'domestication' of technologies reflect over years of adoption and appropriation in order to  
57 gain insight into identifying shaping processes (Berker et al., 2006; James, 2003; Silverstone  
58 and Hirsch, 1992). But less is known about how emerging technologies gain acceptance  
59 within the home, although studies do exist within commercial environments. Francik et al.,  
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1 (1991) attempted to support the adoption of a very innovative multimedia communication  
2 system in a large IT organisation. Considerable effort was required to articulate to users how  
3 they might use this new system. Because it was so radical it required the organisation to  
4 form different tasks so that it could be evaluated effectively. Grudin (1994) identified a  
5 number of barriers preventing successful implementation of collaborative communication  
6 technologies or 'groupware'. Many of the reasons alluded to a mis-match between the  
7 intended groupware functionality and the subtle and complex social dynamics which  
8 determine personal, social and organisational success. Groupware system design was too  
9 inflexible and insensitive to local and ever-changing idiosyncrasies of team working.  
10 Suggestions were provided about how to improve the adoption of groupware, many of these  
11 recommendations emphasised the importance of incremental change and an awareness of  
12 and building on existing successful practice. For example Scholl et al. (2006) found that  
13 informal low bandwidth text-based communications can migrate to a high bandwidth channel  
14 such as video mediated chat in order to preserve informal communication. Groups need to  
15 preserve a 'field of connection' between group members and require constant monitoring and  
16 negotiating to be effective (Bonnie, 2005).

17 Thus, commercial studies reveal similar implementation and adoption issues to those found  
18 in the domestic studies discussed in this paper. Social practice is resistant to change but at  
19 the same time new opportunities to formulate new channels of communication may also be  
20 exploited. However, domestic users usually enjoy a higher level of discretion with less  
21 imposition to adopt new domestic communication technologies because families can make  
22 their own purchase decisions but also critically, in the long term, they also have discretion  
23 about use and non-use. Adoption behavioural patterns in the home are likely, therefore, to  
24 be even less predictable than commercial environments. Nevertheless, this review helps  
25 support the claim that new communication technologies destined for the home are slowly and  
26 progressively shaped by identifiable and predictable themes of social practice.

### 28 3 Communication technologies in development

29 Many researchers have argued that an important prerequisite to the development of new  
30 domestic technologies is the need for a contextually rich understanding of domestic life to  
31 provide parameters for design activity (Blythe and Monk, 2002; Crabtree and Rodden, 2004;  
32 Hughes et al., 2000) or more specifically to provide guidance on new technologies for existing  
33 communication methods (Crabtree et al., 2003). Research groups have set up smart homes  
34 (Taylor et al., 2006) in order to explore more practically the potential implications of new  
35 communication technologies. The motivations for such studies are usually to identify new  
36 communication media, to make predictions about their social effect, or to explore how these  
37 new technologies can enrich domestic communication. The emphasis of this work is on the  
38 building of new communication technologies or the augmentation of existing ones.

40 However, predictions of real use with new technologies are difficult when confronted with  
41 families that can be highly discretionary adopters and long-term appropriators. This poses a  
42 dilemma for researchers attempting to form a reliable understanding about the significance  
43 and true impact of novel communication technologies. Abowd and Mynatt (2000) highlight  
44 some of these difficult research challenges and highlight the inevitable incompleteness and  
45 vagueness which surround devices supporting everyday living. They state, 'In order to  
46 understand the impact of ubiquitous computing on everyday life, we navigate a delicate  
47 balance between prediction of how novel technologies will serve real human need and  
48 observation of authentic use and subsequent co-evolution of human activities and novel  
49 technologies (p64).'

51 This delicate balance can be observed in the recently completed Equator research  
52 programme ([www.equator.ac.uk](http://www.equator.ac.uk)) an interdisciplinary UK research collaboration (2001-2006).  
53 The aim of the programme was to examine the relationship between the physical and the  
54 digital through 'experience' projects. One of the signature characteristics of the project was  
55 the use of invention, innovation and playfulness of technologies to drive research thinking  
56 (Rogers et al., 2002). Through this process, one of the key design goals, seamlessness, was  
57 brought into question, that is, movement between physical and digital devices and  
58 environments should be principally invisible by component tools and systems retaining their  
59 individual integrity but sharing universal compatibility. The project highlighted how users can  
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1 benefit from quite the reverse and being made aware of boundaries between physical and  
2 digital domains. Thus, they argue, careful attention needs to be placed on deciding between  
3 seamless system integration and seamful integration where limitations between interactive  
4 systems are carefully revealed (Chalmers and Galani, 2004). Boundary awareness was an  
5 important issue in this project because the communication technologies were intentionally  
6 developed to be innovative, radical and major departures from established technologies.  
7 Disruptive technologies therefore required greater peripheral support and explicit interaction  
8 signposting because of their novelty. However, if technologies are adopted slowly and  
9 organically, boundary awareness may not be such an important design requirement.

10 Research attention needs to be drawn away from the design of novel communication  
11 technologies towards design activity that is tied into a broader recognition of the likely  
12 emergent commercial technologies that are beginning to be adopted or where likely  
13 convergence is appearing between different communication technologies. We see evidence  
14 of a need for this approach in another large scale research programme. The disappearing  
15 computer ([www.disappearing-computer.net](http://www.disappearing-computer.net)) was a four-year (1998 – 2002) EU funded  
16 programme. This initiative had similar objectives to the Equator programme by developing a  
17 range of devices that embed into everyday objects; the infrastructures to support these  
18 devices; and exploring new approaches for designing devices in everyday settings, with an  
19 emphasis on coherent and engaging user experiences. They state that their design  
20 philosophy was to design the infrastructure for integration and evolution. One of the key  
21 questions that emerged from the programme was how to make computers unremarkable.  
22 This was achieved through projects such as Stanford University's interactive workspace:  
23 iROOM an environment for the collaborative sharing of varied forms of information; Franhofer  
24 Insitutes's AMBIENTE project which created hybrid digital and real environments using tables,  
25 chairs, desks and ambient displays; and IBM's BlueBoards which provided access and  
26 sharing of networked content. In comparing these three projects, the researchers  
27 acknowledged the difficult challenge of supporting heterogeneous devices and system  
28 architectures and combining this with careful consideration to contextually subtle interaction  
29 techniques (Russell et al., 2005). In a critical review of the programme, the evaluators  
30 reported on the impressive outcomes from the 16 projects and how this has formed the  
31 catalyst for other nationally-based research programmes. The evaluators also noted, 'What  
32 was missing from the activities of the DC Network was an industrial advisory board that could  
33 be there from the very beginning of the initiative to act both as a consulting group but also as  
34 a mechanism for innovation promotion and knowledge / technology transfer'.<sup>1</sup> Again this  
35 emphasises the importance of supporting innovative and creative communication research  
36 with commercial constraints and direction.

37  
38 The 'Things That Think' programme, a research group at MIT (<http://ttd.media.mit.edu>),  
39 developed much of their work through collaboration with commercial organisations, to help  
40 foster applied creative solutions. Commercial companies have also been launched on the  
41 back of research such as 'nTag' which permits information swapping and exchange of  
42 electronic business cards. In this way the research group consistently pushes the design  
43 space dimensions and continue to question the interface between the digital and physical  
44 worlds (Ullmer and Ishii, 2000).

45  
46 There is no doubt that elements of Weiser's envisioned future already exist in the home if  
47 'ubiquity' is defined in terms of the quantity of available computing devices, certainly in the  
48 Western world, computer-based products enjoy high consumer penetration. Desktop and lap-  
49 top computers, mobile phones, and digital audio players are common examples of pervasive  
50 communication technologies. But it is hard to recognise our world today as having countless  
51 devices that are invisibly and seamlessly interconnected as originally envisioned. This issue  
52 of comparing Weiser's vision and our everyday present has been examined by Bell and  
53 Dourish (2007). They suggest that 'ubicomp' research focuses too much on a 'proximate  
54 future' – the research and development of new technologies that are just over the horizon with  
55 a fixated and biased regard for Wieser's envisioned social context of use.

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59 <sup>1</sup> Excerpt (p2) from notes of the final DC Jamboree, 20-22 November 2003, Ivrea, Italy  
60 (<http://cordis.europa.eu/ist/fet/dc.htm>)  
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1 Through two case studies, they illustrate how ubiquitous computing has been adopted in  
2 Singapore and Korea where social and political policy on housing, public transport and  
3 religious practice all play an important part in shaping the creation and maintenance of  
4 ubiquitous infrastructures. In both case studies, network infrastructures were provided on  
5 which services and applications could be built but in practice these were also integrated with  
6 other less obvious infrastructures such as road payment systems and smart postal networks.  
7 Other aspects of geographical and domestic living also affect the implementation and  
8 appropriation of ubiquitous devices such as the use of high-rise, multi-family and high density  
9 dwellings. They contend that ubiquitous computing already exists if one accepts their use  
10 and implementation functioning within a messy world where system infrastructures have to be  
11 negotiated, compromised and coordinated. Ubiquitous computing should not be envisioned  
12 with standardised and consistent infrastructures but thought of more in terms of  
13 understanding social and cultural practice around a negotiation process of incrementally  
14 evolving technology.

15 However, predicting where and how these incremental steps will occur will always be difficult,  
16 Arthur (1999) states that we need to be careful about the factors that influence adoption of  
17 certain technologies. The best, optimum or most economical are not necessarily selected.  
18 As more and more choose one technology over another, improvements are made and  
19 eventually competing technologies are locked out. He argues that even with hindsight it is  
20 very difficult to determine exactly when and how key decision making factors are made. Even  
21 with this knowledge it is very difficult to predict how competing technologies may succeed.  
22 New technologies are easy to design but predicting their effectiveness, usefulness and  
23 success is far less so.

#### 24 4 Identifying pragmatic sensibilities

25 By exploring past present and future adoption of domestic communications technologies and  
26 combining these with other studies that have introduced, observed or designed innovative  
27 communication devices in domestic and commercial contexts, it is possible to see that new  
28 devices and services will not emerge in unforeseen or significantly creative ways. Thus  
29 discussions about the social and ethical implications of dazzling new communication  
30 technologies (Bohn et al., 2004) are probably unnecessary. Adoption of domestic  
31 communication technologies will continue to be tempered by families having an implicit  
32 sensitivity towards maintaining their own communication practice but also paradoxically  
33 having willingness to adopt new communication opportunities (rather than technologies) that  
34 are perceived as enhancing existing practice. The social accounts considered in this paper  
35 suggest they will inevitably evolve through small imperceptible steps. Therefore research  
36 needs to be aligned to this thinking. Research needs to be cautious about the seduction,  
37 hype and promises often attributed to new innovations (Woolgar, 2002) and place stronger  
38 emphasis on two key pragmatic issues. How communication technologies have been  
39 adopted within the home in the past and secondly how new technologies might arrive in the  
40 home. For example, a domestic environment can either be ubiquitous, that is, a collection of  
41 communication devices that form part of a networking infrastructure, or, be a collection of  
42 disparate but complementary technologies. Imagine a seamless communication environment  
43 formed through the integration of smart notes of paper, mobile phones, interactive notice  
44 boards, a home PC and several televisions. It would be very unlikely all these devices would  
45 be purchased at once. Typically, ubiquitous devices would be accumulated slowly over a  
46 period of time; therefore each device would require stand-alone functionality, common  
47 networking protocols while also being configurable with other devices. It's also highly unlikely  
48 that this diverse range of devices would be manufactured by a single manufacture.  
49 Ubiquitous communication devices are very likely to evolve slowly by growing out of existing  
50 technologies and at some distant point they may amalgamate and be recognised as  
51 ubiquitous. Thus if we are to create new domestic communication technologies with the  
52 promise of being truly ubiquitous, researchers should consider product design more in terms  
53 of negotiation and compromise rather than user-centred innovation.

54 In order to make any significant impact on evaluating and understanding future use of these  
55 technologies, research activity needs to focus on incremental transitions from one technology  
56 variant to another. That is, not only how they evolve and compete in terms of user  
57 acceptance, but equally how commercial pragmatics play their part. Ubiquitous technologies  
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1 grow once infrastructures are in place but do not necessarily evolve in the clean seamless  
2 ways that were originally anticipated. Research attention needs to be drawn away from  
3 conceptual product developments towards solutions grounded within commercial constraints  
4 where key production and consumption decisions are made, particularly in relation to  
5 managing innovation (Christensen, 1997; Smith and Alexander, 1999) and how organisational  
6 beliefs affect design decisions (Faraj et al., 2004).

7 It is no coincidence that manufacturers adopt incremental innovation strategies, the  
8 telephone, for example, took around 60-80 years to become ubiquitous. For commercial  
9 providers of telephone products and services, incremental advancement offer lower adoption  
10 risks. Products with slowly evolving functions and manufacturing methods are generally  
11 more quantifiable in terms of their future acceptance. Incrementally changing products  
12 benefit from having conventional routes to market and more predictable diffusion and  
13 adoption patterns. For these reasons, future communication devices are more likely to follow  
14 incremental patterns of change and will continue to evolve from elaborations of existing  
15 communication devices rather than emerge as completely novel and distinct devices. These  
16 steps are likely to extend beyond the obvious computing and communication industries and  
17 involve unrelated industries such as furniture and building industries. Many research projects  
18 continue to build and evaluate radical and novel devices that ignore these pragmatic  
19 infrastructural issues.

20  
21 Other pragmatic issues are also beginning to emerge as an important aspect of designing  
22 future communication technologies for the home. Due to the threat of depleting global  
23 resources, we may increasingly need to take a closer look at the fundamental purpose and  
24 long term effects of communication technologies within the context of environmental  
25 repercussions. These technologies enable communities to live further apart which, in turn,  
26 creates a greater demand for transport systems (Thackara, 2005). We need to devise new  
27 technologies to help improve sustainability perhaps by reinforcing permanently remote but  
28 socially cohesive groups. Although much of this will ultimately have to be politically shaped  
29 (Stewart and Williams, 1998) future decisions should be informed through appropriate  
30 research evidence. How do we create communication infrastructures that grow, enhance or  
31 maintain social partnerships which have the reciprocal benefit of reducing travel? Can  
32 domestic technologies be developed that positively alter social relationships within the home?  
33 There has been very little research on the meaningfulness of domestic communication  
34 technologies in terms of their content. Current research has focussed on building and  
35 understanding alternative, mixed and novel interaction styles, but little has been achieved in  
36 exploring if mediated communication affects domestic moral values, although some work has  
37 begun in commercial environments (Drake et al., 2000)

## 38 39 5 Conclusions

40 Beck (1992) argues that industrialised society creates a wide range of social, political,  
41 environment and biological risks which need to be managed through 'reflexive modernization'  
42 mainly through political reform through the democratisation of technological development.  
43 This review provides an argument for focussing this reflexive thinking at a pragmatic level.  
44 As designers and researchers of new communication technologies, we need to review more  
45 carefully the more mundane and likely opportunities that will be offered within the domestic  
46 home. Interaction design research needs to continue growing our understanding of how  
47 families communicate and share information. However, this needs to be balanced with an  
48 associated understanding of the commercial realities of design and production. If we are to  
49 make any real impact and influence in this new and growing field, we need to move away  
50 from ubiquity and new communication technologies as a 'spectacle' and recognise that new  
51 communication devices are likely to evolve from the edges of existing products and services.  
52 There is as much to be learnt from historical accounts of communication technologies in use  
53 and manufacture as well as from prototype user testing of new technologies.  
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