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HOME AUTOMATION: RESEARCH ISSUES

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Aims and Issues

The aim of this paper is to reflect upon some of the issues that home automation raises for researchers of information and communication technologies. In so doing comparisons are made to other ICTs in order to explore what more general lessons might be learnt. Intelligent homes constitute a vision of a particular 'home of the future' as well as a related, though not identical, family of home control products so it is important to appreciate how the development of this technological trajectory interacts with older, constantly resurrected and widespread images. As yet there are very few consumers of this technology, but we can at least begin to speculate about people's reactions to both the vision and to product formulations, as well as the implications of those technologies for everyday life.

If we start with some observations about the actual product family, early prototypes of commercial products were first being developed at the end of the 1970s, over 15 years ago, but no-one would claim that home automation has been a run-away success story to date. The idea of extending the ways in which we can control others technologies already in the home has generated interest, a few product offerings and the basis for a nascent industry but many companies have been unwilling to spend a substantial amount of effort to promote the field. What products have appeared have had some, but limited, take-up. Nevertheless, the future of intelligent homes is still an open one and there several ways in which some many of the facilities under discussion may enter the home. This case study shows an ambitious attempt to shape a new product area, involving considerable collaboration between different agents. As in many instances of new product development, there have been alliances, different strategies, conflicts of interest, debate over design issues, discussion of appropriate markets and routes to those markets and scenarios of consumption. Without going into too detailed an account of that history, this paper explores the issues faced when researching an ICT which remains very much under development and therefore somewhat under defined.

Some of the very specific applications of home systems, such as the complex management electricity loads to benefit from multiple tariffs, are relatively unfamiliar to the general public and have not been the subject of popular visions of future homes. However, the ideas of controlling devices at the push of a button, or by voice, or of the 'automatic home' functioning according to pre-arranged program all have a more widespread currency. These images constantly re-appear in science fiction films and TV programmes and for many years have been demonstrated in exhibitions of future homes. In fact, we shall be looking at how these representations of home automation are both complemented by and compete with several other visions of what future homes will be like, which has implications for the producers in intelligent home industry. But the main point is that the vision of future homes is already a cultural form, it is already familiar, loaded with multiple connotations and regularly re-processed by media outside of the control of the actual developers of the technology. This both creates opportunities and poses problems for producers as well as raising questions for researchers concerning how to analyse the relationship between vision and product.

Potential consumers are also influenced by the above images, as was clear from focus group discussions conducted some years ago. Home automation can symbolise a significant step towards the house as a 'technology for living in'. Hence this type of product can provoke speculation about broader issues concerning the nature of home and desired lifestyles. In addition, some of features and applications discussed by producers do imply certain modes of consumption, certain ways of organising home life and relationships with the outside world. So although there may be few actual consumers to investigate at this point in time we can already start to anticipate some consumption issues and thus explore the limits of what can be researched at this stage in a product's development.

Background to Product Development

In essence intelligent homes offer new ways of controlling appliances. This may be in the form of remote control from within or from outside the home or through enhanced programmability where several devices could operate in conjunction. An example would be where a system remembers previous patterns of appliance usage and can turn lights on and off, draw curtains and even turn TVs and radios on and off to convey the impression that somebody is home. Other examples include monitoring and controlling appliances via the phone, lights which are programmed to come on if intruders or smoke are detected, or washing machines which can start up when electricity tariffs are low.

In practice the option of remotely controlling and programming appliances have been achievable for some decades provided enough electronics and later computer power were utilised. But until the late 1970s, the high costs involved of such developments prohibited any commercial mass market product. Nevertheless, the availability of the technology spawned a range of demonstration houses over the last 25 years, both at exhibitions and as enthusiastic individuals, either computer experts or the wealthy, managed to wire up their homes to achieve the type of control now offered by home systems . Meanwhile, from the mid-1960s Governments such as British one have subsidised remote control products for the severely disabled where the high costs and inconvenience of wiring could be justified.

Innovation in control technology in general has involved slow incremental steps rather than major technical breakthroughs, and so over the years we have seen a number of products being developed and sold which offer some of the functionality of the current more sophisticated systems. For example, X-10 units using the electric mains as a medium for simple control of appliances have been deployed by hobbyists since the 1970s and microcomputers have enabled some enthusiasts to achieve elementary forms of control. In more mainstream markets, the infra-red remote controls for operating the television and later other equipment provided one early, and now ubiquitous, example of a control product. Timers have allowed us to pre-program cookers, VCRs and heating systems. Sensors for security and lighting products have appeared, for example, in the lights which come on when someone approaches a house. Thermostats are routinely used for temperature control. The electricity boards provided the first form of control from outside the home through schemes such as 'Economy 7' in the UK (where an outside

radio signal triggers the heating system). What have been called home sub-systems have already appeared, such as audio-visual systems which interlink hi-fis, TVs, satellites, VCRs etc.

Lastly, intelligent buildings for the commercial sector have for a number of years used integrated networks to control heating, ventilation, lighting and security functions. Some of those firms supplying such systems have looked to expand into the residential market and there has been some experimentation with systems in hospitals, hotels and blocks of apartments. Hence, the existence the above precursors meant that designers of home systems applications have not always had to make great imaginative leaps. And of course, they can assume that many potential end-users have already gained some familiarity with control functions built into in existing everyday products.

From the late 1970s, technical trends including falling microprocessor costs and incremental improvements in techniques involving transmission media such as mains-signalling and infra-red prompted a number of companies to consider that a more substantial home system - a local area network in the home - might be a viable product. For electrical installers and control makers, here was a new higher value product to offer. For appliance makers such white and brown goods manufacturers, the home system consisted of more than a set of new black boxes which could be sold to the consumer. In the longer term, it enabled such producers to add value to their existing product lines by incorporating new electronics into the traditional appliances. Once the network was established in homes, yet more functions and hence value could be added to these appliances, or other new products could be developed which could take advantage of this new network infrastructure. Finally, home automation could be made to appeal to a wide range of other actors offering services which could make use of parts of a home systems for their own purposes. For instance, the utilities have had a long term interest in remote meter reading, and the modem connecting the home system to the outside world could also be used for that purpose. Or service engineers could remotely diagnose the nature of faults and save time by bringing the appropriate spare parts when coming to homes to make repairs.

In sum, if accepted by consumers intelligent homes could ultimately prove to be very profitable for a whole range of producers - including builders, telecom equipment suppliers and telecos and cable companies - who could offer services relating to the system. What is probably unique about the case of home systems is the sheer number and diversity of actors who have collaborated and negotiated to varying degrees and who have had to learn to deal with each other's frame of reference and interests. Many of those interviewed in my own research certainly claimed that it was a beneficial learning experience and that it sometimes spurred inter-firm collaboration in other spheres. It might be interesting to follow up the question of whether this exposure to other perspectives influenced different firm's perceptions of consumers or made them re-conceptualise what was possible and so to formulate new product configurations. But at the same time that enormous diversity has also sometimes led to conflicts of interest over matters such as design and standards, and it may have well have slowed some developments where so many interested parties had to be consulted - or won over.

The Shaping of Home Automation: Key Points

This paper will not document all the activities firms, alliances, products, the different designs, standard developments etc., which have taken place over the years. These have been documented elsewhere(Cawson et al, 1995; Heimer, 1995, Wilpert et al, 1994). But there are some key points worth noting.

First, the routes be which different actors have become involved in this area are actually more varied than indicated in the above outline. For instance, the American CEBus standard arose from an attempt to stop interference between the proliferation of different controllers that were emerging. The US Smart House project originated as an attempt to develop new and safer electric wiring before taking on the idea of home automation amongst other innovations. In other words, in some initiatives the vision of home systems was not the initial driving force, but emerged from developments in other technological trajectories - and as we shall see, this process might continue with some of the functionality of intelligent homes coming from actors who would currently consider themselves to be at best at the fringes of this industry.

There has been a certain amount of state support for intelligent home initiatives: for example, the EC programme for the development of a European standard and local authority encouragement and subsidy as in the case of some initiatives in France (1). Thinking for a moment about ICTs more generally, there have been other historical examples of governmental invention in the shaping of media, services and technologies including the involvement of the European state in broadcasting or more recently in the promotion of 'information superhighways' in the US. Such examples remind us of the need to research the various roles of the regional or more local state in as much as they can be actors in the innovation process - over an above providing a regulatory framework - and actors who bring with them their own perceptions and interests (see also, Cawson et al, 1986; Cawson, 1987). In addition, a variety of trade associations centred around home systems have been involved in awareness raising activities, trying to mobilise support for this new product area. This is a standard procedure in many areas of ICT innovation, and the related trade press, exhibitions and conferences perform a similar role. However, the part played by such institutions in shaping ICTs has only rarely been examined.

There has been some conflict over standards, with actors forming alliances based around the promotion off different designs. Just to take one example, the European Home System standard, heavily influenced by appliance manufacturers, evolved towards a 'plug and play' design which end users can easily set up and to which they can easily add new items. Such an arrangement has not interested installers so much since they obviously prefer a system design which is sufficiently complex that their services are required to cope with it. There has been one academic analysis combining actor-network theory with economic evaluation to predict under what conditions these different designs and alliances might be more successful (Heimer, 1995).

Up until now the home systems that have appeared over the years have not been very successful. A number of small specialist firms have emerged to cater for up-market residences and in Europe and it is probable that France has the highest take up in blocks of flats, although some initiatives incorporate a local government subsidy. Products which offer some control options have also started to appear - such as heating systems which also allow users to control a few appliances. Certainly in Europe, many larger firms remain uncertain and wary of this potential market, and compared to other projects home systems remain on a 'backburner'. They continue to take part in conferences and in other ways to monitor the area, sometimes co-operating in partly sponsored EC projects or continuing a minimal involvement through devoting a few staff to work in this area, especially as defensive innovation - i.e. being ready quickly to develop products should the market 'take off'. But it is also worth bearing in mind that generally in most firms different project teams compete for a limited pool of financial and staff resources. This is part of the context in which the innovation process takes place and therefore the extent to which a technological trajectory is taken up and promoted or not depends on factors other than just the merits of the potential product. As regards the specific case study now being considered, in many companies home automation has always vied, sometimes less successfully, for resources against projects being simultaneously developed by other sections within those firms.

Lastly, there has been considerable interest in tie-ins with initiatives from other industries to help finance the entry of this technology into the home, sometimes with the hope of 'piggy-backing' on a product which is acquired for another purpose. For instance, the electricity load management or remote metering interests of the electrical utilities have cited for many years and more recently the idea of sharing human interfaces and modems with providers of interactive services has been explored. Some French insurance companies have been willing to underwrite the costs of some home automation for the elderly as part of package of services and products to support them in the home. So there is always the prospect of providing home control facilities in a variety of guises, thus re-conceptualising the product's identity and parameters. This is why the verdict on the future of home control technology must remain somewhat open-ended.

Turning now to the issues raised by home systems, one question concerns the extent to which the development of some ICTs may be more researchable than others, for example, in terms of gaining access to certain types of information. In the case of home systems many discussions were semi-public because they involved so many different interests. Therefore, there was a certain amount of documentation available and numerous informants concerning what happened in different meetings. On the other hand, there was potentially enormous number of people to interview given many firms were involved, there were many small initiatives, they were geographically dispersed in different countries and as interest faltered in some companies, the early staff involved were moved to other projects and sometimes became untraceable. In fact, I was only able to keep in touch and gradually increase my knowledge of the area 5 years after the initial research is because I was paid to monitor it as the editor of a trade newsletter . To take a contrasting example, when researching early forms of home-oriented electronic

messaging (i.e. before the Internet boom) it proved relatively easy to locate key staff involved in one particularly strategic service run by BT. Therefore, one task for the ICT research community might be to review the status of previous research in this light, to access what factors have shaped or limited our access and knowledge and perhaps to predict how such factors might influence future research projects.

As with some other families of products such as virtual reality, the home automation industry exhibits occasional boundary disputes over what counts as system or sub-system. Obviously this can have implications for measuring the number of products in existence. Perhaps more significantly for a researcher, this uncertainty raises the question of what should be the object research and of where to draw the limits around that subject matter. For instance, in discussing how the features of home systems were developed, is it best to focus on a few well-known prototypes (e.g. Berg, 1990), or on the most ideal, fully comprehensive version of a system as an ideal type or else on a number of core features shared by many if not most products that a majority of those in the industry might be willing to call an intelligent home? Suppose that there never turns out to be a significant market for a product called a 'home system' (or any of the alternative names), indeed many of the potential major players may choose not to launch products thus labelled. Nevertheless, since we are considering enhanced forms of controlling existing appliances, much of the actual functionality now being discussed could gradually and incrementally creep into the home in other guises, as extra features of heating systems, security systems, packages offered by utilities, packages of brown goods offered by consumer electronics firms etc. In which case, should control systems in general be a more appropriate object of study? Nor is this issue unique to home automation. In the 1960s and early 1970s, there were predictions that computer power in the home would be provided by dumb terminals linked by phone to distant mainframes (Martin and Norman, 1973). A researcher that time might have monitored any efforts on the part of the mainframe industry to develop a residential market. In practice, a product called the microcomputer was the vehicle which unexpectedly filled this role of bringing computing power into the home (Haddon, 1988).

Approaching this point from a different angle, previous work at Sussex has used the term 'product space' to capture the nebulous nature of concepts where producers refer to a set of functions and features which a number of different actual product configurations could fulfil (Cawson et al, 1995; Haddon, 1995). However, there is still the question of the degree to which the existence of distinct and discrete product spaces are articulated by producers. Certainly the field of home automation (like multimedia) has been constructed in public discourses, through informal contact and collaboration. We saw how there have been conferences, informal meetings, associations, publications and European Commission funded projects relating to this product space. But we can contrast this with another area studied at Sussex which we called 'electronic messaging' - or more specifically electronically transmitted text-based messages.. This would encompass E-Mail, bulletin boards, discussion groups on the Internet, but also fax and messaging services which could be offered by cable companies. But, there has never been a specific producer community organised solely around such a concept. In fact, messaging has often been packaged with other services under another umbrella name -

such as ‘videotex’. And there has never been a meeting of, say, fax manufacturers and network operators to discuss the future of messaging. The relevant producers have simply not constructed and conceived of the field in this way. Of course, this example points to further possible research questions of why some areas come to be publicly defined as relatively distinct product spaces by commercial interests and other actors while other theoretically possible areas are not recognised as such by industry. But it also raises questions of how much a researcher’s concepts and constructs should relate to industry ones, and what exactly that relationship should be.

One process researched at Sussex was the very attempt to construct communities of interest around both a generic technology and particular standards. This process has been paralleled in fields like multimedia, virtual reality and on-line interactive services. In task forces, conferences and workshops, speakers have outlined various domestic scenarios and explained how these products could be useful in order to convince others of their potential. In the case of home systems, such efforts have been supplemented by pamphlets and other literature such as market research and reports aimed at winning support through constructing evidence to persuade other producers. Through such actions there is attempt, from a supply side, to ‘put a market together’ before a product ever reaches consumers. This may mean trying to win a critical mass of support, as in finding enough service providers for a network or a wide enough range of products to sit on a home system. But it may also mean finding strategic support - for example, in the case of home automation, tie-ins with the utilities would provide a major boost.

Then there is the issue of how to handle the fact that a product space can be relatively central or peripheral for different industrial actors. We saw how home automation presents clear opportunities for appliance manufacturers and installers while other actors, such as utilities or service engineers, have an interest only in a very specific aspects of the product space. For example, cable companies offering interactive services are interested in possibly sharing the same modem link between the home and outside world. In other words, there are some parts of a home automation technology or its functionality which can be shared resources used both by those for whom intelligent homes are a more central concern and by companies with other interests. In one sense, this product space in general is not the main concern of these other companies, but it can still be important to them. Indeed, we saw how their involvement has been encouraged by those at the centre of intelligent home initiatives since agents such as the utilities have the potential partly to finance some of the technology or else add value to the product in the eyes of consumers.

One of the aims of previous research at Sussex was to investigate the processes by which particular application ideas emerged and were developed within firms and within various collaborative efforts (Cawson et al, 1995). Some proposals came to be shared across the industry in everyone’s scenarios while others - like remote diagnostics - were only followed up by a few. In her analysis of early developments in home automation, Berg asks whether those involved had taken into account women’s experience of housework in the home and whether the technology addressed this (Berg, 1990). It is course, entirely legitimate to ask what was considered and what was not in the innovation process, even more so in the light of some bolder claims that the smart homes would do everything.

Our work would concur with hers that domestic labour was not on the agenda. But we can go further and note that the starting point for this whole field was a technical possibility - a home bus - rather than particular application or vision of what end-users might desire. Moreover, manufacturers continue to ask what new appliances could sit on the system, how else could a bus' technological capacity be used and what, perhaps as yet unknown, application could arise. But this situation of a technology chasing applications is actually common to ICTs. Different kinds of electronic capacity can potentially be used for multiple purposes as in the case of media conduits such as the telephone, cable or radio networks, the storage capacity of microchips and compact discs and the processing power of microprocessors. So for example, with videotex the question constantly being asked was what information and services would be of interest to domestic users. In the case of electronic messaging what type of messages would people wish to send and receive on such a system? And with the new generation of interactive CD technology, what types of software would potential consumers want to have and to manipulate? This pattern may not be unique to ICTs. For example, earlier this century the electrical utilities sought to develop appliances that would utilise the excess electricity which they generated, although in this case existing mechanical or gas powered appliances could often be converted to electrical versions (Forty, 1986). However there remains the question of what bearing this feature of much ICT innovation, this search for applications, might have on the research questions and forms of analysis which social scientists develop.

Even if actual consumers or visions of consumers often play little part in the initial generation of the idea for a product space, we can still ask at what point and in what forms they feed into the innovation process. In the case of home automation, the earlier Sussex research noted such aspects as the complex role of consumer research in product evaluation and how the domestic experience of engineers had a bearing on the generation of scenarios (Cawson et al, 1995). But sometimes it is not so much direct inputs that play a part as indirect ones whereby developers, acting almost like detectives, search for clues about what goes on in households and how this might change. As an example, for years producers have looked for signs of how much and what forms of 'interactivity' with technology the public might come to enjoy. Such clues sometimes emerge from advertisers, market researchers or other consultants developing lifestyle analyses. But perhaps more importantly, product developers look to the past and current experiences of other ICTs, trying to learn lessons, anticipate and avoid problems (like the famous VCR format battle) and decide which other ICTs might provide a precedent (2)

The technology-driven nature of this ICT innovation needs to set against the more recent efforts of technological-based companies to be more sensitive to markets. Taking the consumer into account is the advice emanating from marketing literature and courses, and is currently being given further impetus as ex-utilities are privatised and undergo transition to a new corporate culture. At first sight, one might be critical as to how much has really changed. Product managers are usually ex-engineers, although they often try to differentiate themselves from the real 'techies' who are still based in the lab. However, in the course of our research some of these staff admitted their uncertainties about consumers, they brought in consultants, including social scientists, to provide a

perspective on consumers . Some of the Scandinavian telecos have gone a stage further and started employing full-time social scientists. So there are questions to ask as to the extent to which a significant, albeit slow, change in the innovation process might be coming about.

Finally, this brings us to related point of the role social scientists might play in innovation, and hence the politics of research. For instance, at the same time as researching home systems, the Sussex team was also asked to evaluate various British Telecom future products, review the marketing and related literatures on new product development for them and write a handbook offering some guidelines to developers within the company. For some years as co-editor of a trade journal on intelligent homes, I have been involved trying to raise awareness of consumers and consumption issues and possibilities. Admittedly, financial considerations play a part as more and more researchers seek contract work from sources other than the state and indeed at conferences other researchers have noted that over the years their agenda has had to change to fit in with that of the institutions which employ them. But given that critique that ICT innovators fail to take consumers into account adequately, there is also an argument for trying to influence the whole process if given the chance. On the other hand, that incorporation of academics itself has implications: not only it likely to temper the level of critique but means that researchers are probably not going to be in a position to fundamentally change processes, for example by suggesting a radically different starting point. In other words, there are questions not just of how influential the presence of social scientists would be but also of how that incorporation actually structures the type of input which they are allowed to make.

Home Automation as a Vision

A literature has now started to amass which explores what innovations have symbolised beyond their functionality and immediate applications. For example, historical analysis on the origins of new technologies has examined contemporary speculations about what X-rays, radio, nuclear power, the telephone, the electric light, plastic and the computer could mean (Corn, 1987), how some of these innovations might change society or how they might have little impact, remaining essentially toys (Aronson, 1977). More recently, the British home computer boom of 1980s involved buying the microcomputers not just for what they could do but because they represented for many participation in some vaguely defined computerised future (Haddon and Skinner, 1991; Skinner, 1994). These writings, then, often chart the role of agencies other than the actual innovators - including political and social commentators, the media, the entertainment industries - as they fuel discourses about the meaning of these new developments.

When we consider intelligent homes it may be more appropriate to start with more general visions of homes of the future. Such images have a long history in the press, fictional novels, film and latterly TV, especially through the science fiction genre. Writers and film producers have often speculated about future homes, in part as a source

of entertainment through evoking anthropomorphic, threatening and comical representations. But homes of the future have also been used to explore social issues, utopias or dystopias. Commentators have asked what implications the form and contents of houses have not only for personal lifestyles but also for wider social life: for example, what type of people might we become if there is less and less need to leave the home and what does this mean for communities.

Moreover, such visions of future homes are not just some historical legacy: prediction-making is an on-going process. In fact, media coverage of home systems products in the 1980s and 1990s has itself evoked somewhat familiar images of the future, as have a range of other high profile technological developments (Dutton, 1995). Some of these have even been taken up in academic debates concerning what this innovation represents (Robins and Cornford, 1990).

In addition to the role played by the media, exhibitions of future homes such as those on show at World Fairs or ones organised by manufacturers have often been designed to create a sense of wonder, of marvel, even of fantasy. Indeed, one showpiece building in the 1930s was named the 'House of Magic' (Horrigan, 1987). Recent years have witnessed a number of ‘Home of the Future’ exhibitions in various countries, sometimes located in theme parks, whose function is either to entertain visitors and/or act as a showcase for the latest technologies and designs (3).

However, these vision have been by no means homogenous and indeed new images of future homes have emerged. Hence, the idea of more control of domestic systems and appliances, sometimes in the guise of the computer home, is only one image amongst others. Some of the alternative elements of future homes include a house full of more and more gadgets or radically different architecture and interior design, which may or may not include moving furniture and interior walls. Increasingly we encounter the idea of having robots in the home. With the concept of ‘wired nations’ or nowadays ‘information superhighways’ we have the home as an information centre where inhabitants can, 'at the press of a button' seek information from the outside world or conduct remote transactions via telecommunications. And in various senses we are also more likely now to encounter the environmentally sound home.

What are the implications of all this? First, home automation has to compete for attention with these other elements, and sometimes loses out through being less overtly visible. For example, in one Dutch Home of the Future home systems appeared less interesting precisely because they are located amongst more glamorous, eye-catching innovations: in a house whose roof is opened by hydraulics, where open-plan, spacious rooms are contained in curved walls and where you can find a plethora of the latest gadgets. Second, home systems become associated with these other visions. In focus group discussions on home automation which I conducted in the late 1980s, the participants would spontaneously start volunteering points about robots or evoking the other visions noted above. And as a researcher I was approached by one newspaper whose editor argued that whatever the proposed article actually said about home systems, there had to be a picture of a robot!

This latter example raises the point that the media and exhibitions not only conflate different images of future homes but they do so because of their own logics (4). In the case of the press, the robot image was more visually interesting and on occasion TV producers have complained that home automation was not televisual enough - you could not see enough happening and when it did so it was a mundane event. Apart from the visual side, the media also have their own values - while the bright technological future is always vaguely interesting for ‘news’ or as a fictional theme, so too is the house that goes disastrously wrong.

To take another example of the clash between media interests and producers, one marketer complained of the coverage given to home automation by two British TV programmes on the grounds that their every framed home automation in futuristic terms or else trivialised it.

"There's no control over the voice of home automation in this country and I think this is very wrong. The 'Tomorrow's World' coverage was on their section that was the 'Home of 2020'. Well, that put's it too far away. That means that half the population that see that think that home automation is something that isn't going to be around for ages. Then you've got the little 'Q.E.D.' man telling you look at this lovely gimmick that you can perhaps buy next year!"
(Cawson et al, 1995).

Visions of future home have at times provided a source of inspiration for product designers. The 'Butler-in-a-Box' system with voice recognition and synthesis is perhaps the most clear-cut case, where its inventor noted how he was actually inspired by a film on computerised homes called 'Demon Seed'. But there are more subtle forms of influence. To take that same example, debates about the pros and cons of voice control systems have been discussed in technical terms - e.g. concerning the difficulty of training voice recognition system and their reliability. But in addition, some producers have been wary of this interface precisely because it can all too easily come to symbolise computerised or even anthropomorphic homes given that this feature is often found in science fiction films.

Finally, producers have had to deal with the fact that this background of media and other imagery can colour how people react to home automation in general or to specific applications. It can do so even within the producer community itself, so when key players have tried to win support from other industries they have often taken some care with the demonstrations and the scenarios which they evoke. In addition, while these visions of future homes means that potential consumers are already familiar with some product ideas, it also influences their evaluations: they can and do evaluate not just the particular applications, but also the wider issues these may imply (5).

To take one particular feature, most home systems developers have tended to shun futuristic connotations in their marketing literature and prototypes Sometimes such associations with the future can support a product. For example, many early home

computers were marketed as a means for households to get a foothold in the new information technology society (Haddon, 1988) and early radios were often sold as the opportunity to possess one of the latest wonders of science (Forty, 1986). But on the whole, certainly many of the larger European companies in the nascent intelligent home industry have tended to be wary of this approach, locating their demonstrations in 'ordinary' houses, exhibiting in venues such as the (present oriented) Ideal Home exhibition and generally stressing the practical benefits of intelligent homes in more mundane terms such as 'convenience'. 'cost-saving' and 'security' rather than emphasising that people have the chance to live in a 'gee-whiz' house.

Consumption

Since to date so few home systems have been sold, it is hardly surprising that most commentaries on the potential experience of intelligent homes have been of a speculative nature. There have been reports from experimental installations (e.g. Rossel, 1994), but while these might provide some clues as to consumer reaction, this is still likely to be of a short-term nature. It could take years for a technology's presence in the home to give rise to new practices or perceptions, or affect the relations between different household members. Hence the following discussion can only make observations about the possible reception and consequences of home automation based (a) upon features of those systems and scenarios of use together with (b) insights drawn from Sussex research on the consumption of other ICTs. It has also been made clear that the very notion 'intelligent home' is an umbrella term for a wide range of products on a continuum of sophistication which at best share a family resemblance. Therefore the issues raised below are based on some of them more common, although sometimes more advanced, design features and scenarios.

To start with a link to the above comments on visions of future homes, my own involvement with market research focus groups illustrates the potential symbolism of home automation. While much of my own input related to particular design features, at various points in all the groups there was some spontaneous reference to images of the technology going out of control or breaking, or people becoming too dependent on technology, sometimes too home-centred. The modem link between a home system and the outside world evoked comments on Big Brother or worries about hackers. Often particular films were cited to conjure up the appropriate image, classics being Charlie Chaplin grappling with an automatic feeding machine in 'Modern Times' or 'Mon Oncle'. Sometimes it was anxieties about home technology in general which were being voiced where the idea of intelligent homes could make people stop and think in broader terms about their lifestyles, the nature of home and how much existing everyday life was constructed through the use of technologies. The point was, did a home system cross a threshold of acceptability? Was it the place to draw the line about how much technology to allow into the home because it was that much of a step nearer to being Le Corbusier's 'machine for living in'? On the other hand, many of the focus groups at some point suddenly took on a party atmosphere as more and more fanciful scenarios were suggested

about what could go wrong or how people might behave differently in an intelligent home. The participants often played with the idea, competing to generate laughter through the funniest images. This might be worrying from a producers point of view in that there product was not being taken seriously. But as with the anxieties noted above, people in part reacted to the historical and contemporary role such visions had played - as vehicles for reflection or as futuristic entertaining spectacles.

What is being sold with home automation is the promise of more sophisticated control over the technology already in the home - whether or not that subsequently leads to greater convenience or peace of mind. But the problem is that the ambivalence people feel about whole issue of control is grounded not only on the type of media imagery noted above but also in their own previous experience of domestic technologies. From the Sussex research on home-based ICTs we noted how people do not always feel in control of their televisions, in the sense that they find themselves slipping unconsciously into patterns of viewing because the technology is simply there. They certainly do not always feel in control of their telephones when their daily lives are disrupted by the intrusion of the outside world or when, like the TV, the phone is too tempting and bills started to escalate (Haddon, 1994). In fact, some realised how dependent they have become on that particular technology (Haddon and Silverstone, 1995; Haddon and Silverstone, forthcoming). Add to this the fear of losing or lacking control that emerges when people literally cannot get to grips with using a technology or faults in the technology lead a product to 'play up', such that it seems to have a life of their own. No wonder, then, that there is a basis for scepticism over whether the intelligent home's promise of more control will match the reality.

Referring back to the earlier observation that the multi-functionality of many ICTs might be a generic feature of this type of technology, that very open-endedness has often been accompanied by firms in effect encouraging end-users to experiment. In previous work on the home computer, it was noted there was a complex process by which producers and consumers attempted to construct 'usefulness' and indeed for a considerable number of consumers, especially but not solely male hobbyists, such experimentation was a pleasure in its own right (Haddon and Skinner, 1991; Skinner 1994). Of course you can experiment with the increasingly sophisticated controls on washing machines and microwave ovens, but the scope for doing so is not of the same order as, say, exploring the Internet or finding out about the different circumstances under which it is convenient to use (or not use) a mobile phone. And in fact, many ICT producers talk in terms of initially delivering a wide range of applications or services in order subsequently to find out and promote further the ones that end users discover to be most appealing (8). In a sense, this is indeed inviting the consumer to play a more active role in shaping of a technology. And to some extent this same offer to experiment is implied with home automation, where consumers can configure their systems in different ways and discover from a variety of options which features might be most interesting.

It has been argued that the advent of home systems is the latest manifestation of much longer trend towards making the home more like an factory in terms of some of its rational, organising principles - in other words, introducing scientific management into

the household (Robins and Cornford, 1990). Certainly many of the applications seem to imply a certain amount of pre-planning and thinking ahead (as opposed to spontaneity) from programming heating systems in complex ways to arranging for appliances and lights to turn on and off to create a semblance of presence for security purposes. Some of the energy-saving features imply that users will spend more time calculating energy costs and possibly changing patterns of use if given access to more information about their energy consumption. We must at least ask whether manufacturers are deluding themselves about home life or whether new ICTs can encourage new forms of behaviour, in this case maybe creating new types of 'organising work'. After all, there are precedents. It is argued that domestic appliances may not have reduced the amount of housework so much as changed its nature as higher standards are expected. Other argue that the telephone has allowed us to maintain social links to families which are increasing geographically dispersed, and engage regularly in social activities and with social circles which are at a distance, no longer in the immediate neighbourhood (Häußermann and Petrowsy, 1989). It is also worth adding that home automation is by no means unique specifically in implying that the home can be more like the workplace of paid employment: the home computer's word-processing, calculation, and data storage facilities have often been marketed as part of a vision of how the home may operate according to criteria of efficiency and organisation imported from the office.

When evaluating the consumption of any one ICT it needs to be set in the context of other technology and service development. Elsewhere we have noted how technologies can have careers in the home, can experience changing use and roles and give rise to new disputes and rules (Haddon and Silverstone, 1994). For example, the arrival over the years of the VCR, cable and satellite, computers and games - all of which can make use of the TV screen - has a bearing on the experience of the TV set. Or the innovations like the radio phone-in, chatlines, shopping by credit card or the Internet can influence the role of the phone. Similarly, might not other technological developments have repercussions for the attractiveness of home systems? For example, mobile telephony has enabled people to make arrangements more on the spur of the moment when out and about, or make contact with people being visited when setting off or just about to arrive. Could such a 'just-in-time' lifestyle make more appealing the scenario of interacting with the home when underway?

In addition to a changing technological context, home automation, like any other ICT, would have to be set against a background of broader social changes which could have a bearing on its reception. For example, we have documented how teleworking can have a bearing upon a whole range of aspects of domestic life, affecting the organisation of time and space, the boundaries between public and private and relationships with social networks - all of which have ramifications for ICTs (Silverstone and Haddon, 1993). Without wanting to claim to much about any particular trends around teleworking, the example makes the point that we need to be attentive to the consequences of changes in such areas as work, leisure, mobility, people's sense of security, environmental consciousness etc. In addition to any broader, long term shifts, it would be wise to bear in mind the potential influence of more particular events such as the coming end of the century which may well cause some discussion of lifestyles after the year 2000 (6). Finally, to take a very specific and recent example of the influence of small but

significant events, although closed circuit TV cameras monitoring public spaces have been around for years, there have often been civil liberties issues concerning their use and the symbolism of the 'Big Brother' state. However, following their successful use by the British police to help capture a child's murderers, their presence in British high streets has recently expanded hugely and with considerable public support - to an extent which even surprised the manufacturers of this equipment (7).

One set of questions we would of course want to ask concern how home automation might have bearing upon relationships between household members. In the light of research on previous domestic appliances, we might be interested in whether this new technology would influence patterns of domestic labour within the home (Wilpert et al, 1994). But that is only one framework for analysis. If we think of an analogy with the TV remote controller there is the issue of whose finger is on the button and drawing an analogy with the VCR, who sets up a system and does the pre-programming. Those type of questions - who defines what controls are used on whose behalf - would also apply to home systems, and with them the broader of issue of whether a technology can be used to reflect, demonstrate, strengthen or diminish existing power relationships (9). An example would be the new power parents might have remotely to turn off or turn down equipment in a teenager's bedroom. Moreover, home automation also brings with it more powers of surveillance - not just through the closed circuit cameras envisaged in some scenarios but because it may well be possible to monitor what is being used or has been used, given usage on the system might leave electronic traces. Recent Sussex research has noted how surveillance-enhancing options such itemised-billing have caused conflicts within households while other technologies have had the potential to reduce surveillance, such as extension and cordless phones, and so can help create more private and personal spaces in the home.

Lastly, we would need to pay attention to the ways in which the arrival of home systems might effect boundaries with the outside world. For example, remote metering, certain forms of remote diagnostics and some of the security monitoring services available could all enable outside bodies to cross the threshold and electronically look into the home via the home system. In some scenarios the home's appliances can remotely be given a periodic health check for signs of decay and in another (admittedly very speculative) scenario the intelligent home automatically dials a repair service in the case of a breakdown (10). Some have discussed the possibility of using home systems to monitor the infirm, perhaps those suffering the onset of senility, in order to send out alarm messages if they drastically fail to follow their normal patterns of behaviour (11). But such examples, together with the fear of hackers remotely infiltrating the home system, raise the question of how much people might lose control over their privacy and over the boundaries around the home.

Conclusion

This case study has been used to chart the range of issues which might be of interest to researchers of ICTs. It has worked through three key dimensions of the ICT as cultural artefact: the social construction of a technology, how that technology as text and

discourse is embedded in related representations and finally questions concerning the consumption of that product. As a particular worked example the specificities of intelligent homes have been highlighted. But since the study is a vehicle for exploring more general issues, the paper has attempted to reflect on the extent to which forms of analysis and problems could be applied to a broader range of ICTs and themes developed further.

Footnotes

1) For more details of the French market see *The Intelligent Home* (1992) 'Home Systems in Action in France', Vol.2.,No.4 pp. 4-5; *The Intelligent Home* (1993) 'French Developments', Vol.4,No. 4 p.4 and p.11; Rossel, 1994)

1) The same process of convincing manufacturers that about the viability of an innovations has also been noted in the case of the telephone in the de Sola Pool collection (1977) and the microprocessor in Reid (1985).

2) The search for appropriate precedents for CD-*i* is discussed in Silverstone and Haddon, 1993.

3) A range of European constructions bearing the name 'Home of the Future' have appeared over the last few years. The Huis van de Toekomst, Rosmalen, The Netherlands lies in a themepark. The Portuguese Project Utopia, located in the luxury resort of the Val do Lobo, Algarve, was inspired by the same TV celebrity as its Dutch counterpart: Criet Titular. The Maison du Futur is a more modest affair, a permanent exhibition apartment in La Defense, Paris, France. For more discussion, see *The Intelligent Home* (1990) 'Showpiece Homes of the Future', Vol.1, No.3, pp. 4-6; *The Intelligent Home* (1992) 'European Update', Vol.3, No.3, p.8, On an initiatives in Brussels see *The Intelligent Home* (1995) Living Tomorrow, Vol.6, No.1, p.9.

4) For more examples and discussion see *The Intelligent Home* (1990) 'An Image for home Automation', Vol.1, No.4, pp.9-10.

5) These observations are based on the author's market research work involving 14 focus group discussions - some of whose findings were published in RMDP (1989). Smart House staff have also noted that science fiction in particular influenced the ideas and responses of consumers involved in its early market research.

6) *The Intelligent Home* (1992) Vol.2, No.4, p.1.

7) *The Intelligent Home* (1993) 'At Home with CCTV', Vol.4, No.2, p.6.

8) In the case of CD-*i*, Philips advertisers advocated such an approach, for example, and in practice the Dutch multinational ramped up its production of games once it found these to be the most popular application (Silverstone and Haddon, 1993).

9) This issue is broadened to include relations with non-family members of households such as lodgers and paying guests in *The Intelligent Home* (1993) 'Caring Friend of Big Brother?', Vol.3, No.4, p.7.

10) For further discussion see *The Intelligent Home* (1994) 'Diagnostics Reconsidered', Vol.5, No.3, p.4.

11) *The Intelligent Home* (1993) 'Caring Friend of Big Brother?', Vol.3, No.4, p.7.

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