The Home Workshop

A Method for Investigating the Home

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Abstract

How families engage with their technologies in the home is important as there is an increasing interest being shown by manufacturers and researchers towards the home. The lessons from over twenty years research in Human-Computer Interaction indicates that people need to be involved in a process which may have an impact on their lives. The question arises, then, as to how designers can investigate the needs and wants of people with respect to technology in the home.

This thesis presents a new method that facilitates requirements gathering in the home with a heterogeneous group of users. The method is called the Home Workshop and it draws mainly on methods that have emerged from Participatory Design. A study of five households' use of technology was conducted in central Scotland, each were visited on three occasions, using the Home Workshop method. The data was analysed using grounded theory and ethnographic software.

The results show that an investigation of this nature can help uncover clues to our relationship with technology in the home. It can also give directions to designers who are hoping to design technology for innovative home concepts. It has been demonstrated that the general public can participate in a workshop in the home successfully and ideas and valuable contributions can be expected both from children and from the elderly.

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I would also like to thank the five households who took the time to take part in this study. They provided me with a very rich set of data; I hope I have done it justice here.

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Publications arising out of this thesis

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Baillie, L., Benyon, D., MacAulay, C., Petersen, M (2002) Investigating design Issues in Household Environments. Cognition Technology and Work, special issue of the best of the Oikos2001 working conference. The paper has been accepted and is currently awaiting publication.

Baillie, L., Benyon, D. (2001) *Investigating Ubiquitous Computing in the Home.* Workshop on Ubiquitous Computing in Domestic Environments, Nottingham, UK, September: 13-14, 2001, 16-33.

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Petersen, M.G. and Baillie, L (2001) *Methodologies for Designing Future Household Technologies.* OIKOS 2001 Working Conference: Methodological Issues in the Design of Household Technologies, Molslaboratoriet, Denmark, March 12-13, 2001, 47-50.

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1 Introduction

If we stopped to think why our artefacts – our saucepans, cars, refrigerators work or take the form that they do, we would never get round to making the coffee in the morning. Therefore we stymie our curiosity, but this lack of curiosity carries costs as well as benefits. Our artefacts might have been different. They might have worked better. They might not have failed. The might have been more user friendly. (Bijker and Law, 1992, p2.)

1.1 Introduction

In 1999 I was a member of a research project, FLEX[1], which was interested in gathering requirements from the home to facilitate the building of a new home technology. The main objective of the FLEX project was to design and build a new type of device for the home called the 'Home Information Centre' (HIC), Figure 1.1, taken from the project proposal, illustrates the concept.

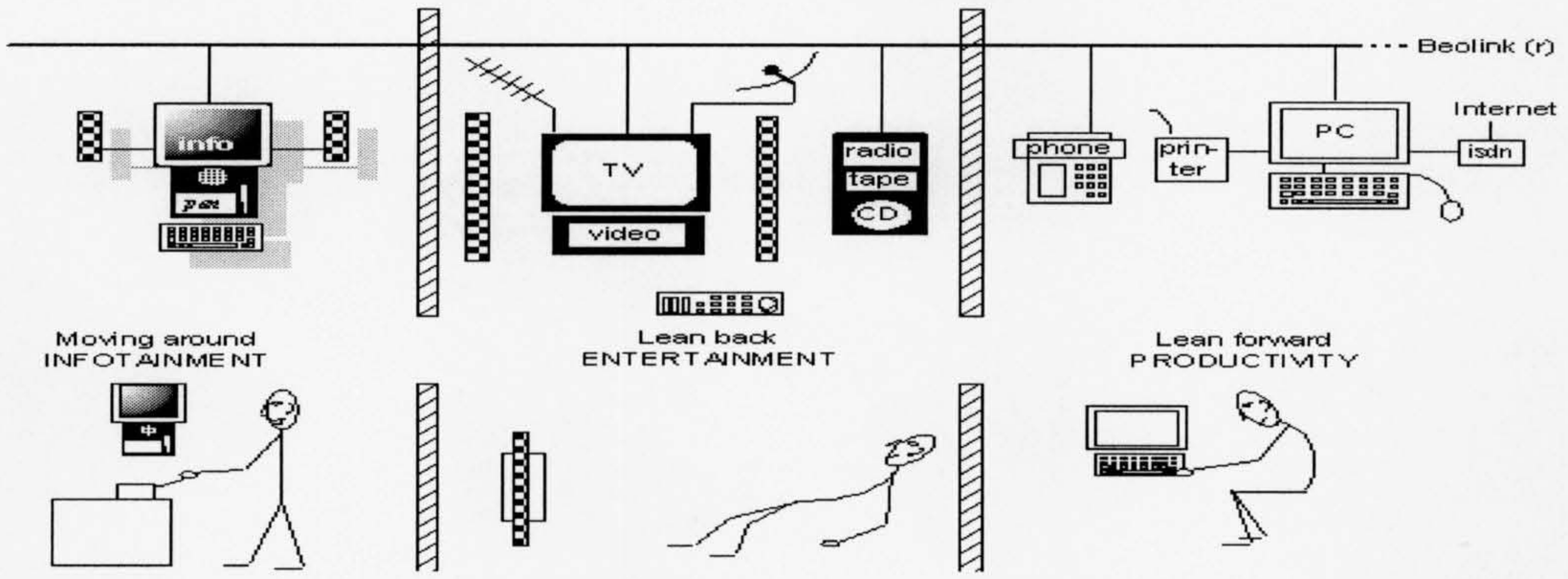

Figure 1.1: The HIC constitutes a new concept in the home, providing 'infotainment' in a moving-around situation. It merges entertainment equipment with the information facilities of the PC and the phone.

It was proposed that the user could activate functions such as an MP3 player, television, radio, internet and email from the HIC touch screen. The FLEX project team were charged with developing an 'intuitive interface design'. The main problem was how to undertake a user-centered design process when the users' needs were not known because the HIC was a new concept. One of the motivations for this thesis came from the investigation of the very real problems identified by the FLEX project, i.e. how to understand and design a new device for the home when it is not known what the users' needs may be and those needs cannot be studied in any seriously comparable system.

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[1] Flexible knowledge-based information access and navigation using multi-modal input/output (FLEX)

There were a number of questions arising from that project, such as:

- Where in the home should a device of this type be placed?
- Which multi-modal inputs and outputs proposed (e.g. output: sound, images, text, animation; input: voice, touch screen, pen, keyboard) are appropriate for the home?
- What applications and functions are desired and appropriate for this setting?

These questions required answers and it was felt that undertaking studies of technology in homes was an appropriate way of finding them.

The problem with undertaking an investigation in the home to facilitate the design process was the lack of reported literature and research on household settings. The main foundation of Human Computer Interaction (HCI) practice has been in the laboratory. The use of laboratory studies was found to be problematic as many of the laboratory findings could not be extrapolated to the real-world setting of the workplace. HCI practitioners realised that to meet real-world needs the discipline would have to evolve into the workplace. A further question is can HCI methods in their present form take the next step and inform studies in the home?

HCI research has concluded that successful design must be user-centred (Norman and Draper, 1986). This message has, to a certain extent, been heard by mainstream computing, but if the degree of end-user involvement in published HCI studies is examined, examples of full 'partnership in design' are difficult to find. Some research projects have investigated technology in the home but the focus had not been in the requirements-gathering or design stages but at the evaluation and end product marketing stages. For example, some studies had concentrated on observing new technology in the home to which the intended users have not contributed (e.g. O'Brien, Rodden, Rouncefield and Hughes, 1999) while others have investigated the use of technology that is already present in the home (e.g. Venkatesh, 1996; Kraut and Mukhopadhyay, 1998).

Another mode of involvement of people in their homes is exemplified by the 'Cultural Probes' of Gaver, Dunne and Pacenti (1999). They asked participants to provide information about their lives, when the designer was not present, and did not plan to involve them in the subsequent creative part of the design process.

However, there is a rich seam of sociological studies in the home to be drawn upon that have employed different methods, such as ethnography and in-depth interviews. This is when the second real-world problem facing the project team became apparent: as only a very limited time was available to collect households and data, lengthy longitudinal studies such as those employed by Morley (1986), and Csikszentmihalyi and Rochberg-Halton (1981) among others, were not practicable for this project.

An important point to note was a dearth of studies involving whole families. Many of the studies stated that they involved whole families but upon closer inspection it was discovered that this was not the case, the data obtained was mainly sourced from the adults in the households. There was, therefore, a scarcity of information on how to investigate children's use of technology in the home.

This lack of reported research meant that the FLEX project faced the real-world problem of not having enough time and not knowing which HCI or other methods could be effectively extrapolated to the home setting. It should be noted that the problem of effective user involvement was not just one facing this project team but, as was discovered at the HOIT[2] conference, was one facing many project teams. HOIT is the conference of the IFIP 9.3 working group.

The HOIT conference was held in June 2000 and was entitled: 'IT at home: virtual influences on everyday life.' The conference's main aim was to improve understanding of technology in the home environment. It was hoped that this conference (as the only one of its kind, at that time, dealing with home technologies) could offer insights into how to investigate the use of technologies in the home and put forward some ideas about what people in the home may want from their devices in the future.

The conference did indeed highlight interesting research that was taking place in the area of home-orientated technology, but a more interesting finding was that investigations lacked a theoretical framework and methods that could facilitate full user studies in the home.

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[2] Home Orientated Informatics and Telematics (HOIT)

Kjaer, Madsen and Petersen (2000) pointed out in their paper that the home was a difficult place in which to undertake a study of a device, and further that they had encountered problems with using the tools and techniques commonly used in HCI to undertake their studies. Therefore it was of interest that at the very same conference Monk (2000), in his paper on user-centered design, highlighted that there was a requirement for investigations to take place to see if there was a need to adapt existing techniques, utilised by HCI, or invent new techniques so as to undertake user centered design for the home. He also highlighted that the field was lacking basic concepts for user-centred design in the home; namely those of ease of use, ease of learning, and task fit.

This conference was not alone in its call for methods to be produced that could facilitate investigations in the home, O'Brien et al. (1999) called for investigations into the ways in which homes could best be investigated. Industry was also appealing to HCI researchers to develop methods for investigating the home, to aid in the understanding of the organisational context into which a device would be placed (Lachoo and Anderson, 2001).

In conclusion, the main barriers to undertaking an investigation in the home were that there were no existing methods in HCI that had been used to facilitate an investigation of this nature in the home, and that other methods from other research areas such as sociology involved studies taking place over an extended period of time. This study intended to include all members of a household and involve them in a design process which was not something common to sociological or HCI studies in the home. Accordingly a programme of research was undertaken that has resulted in this thesis. Section 1.2 and 1.3 outline the aims and contributions of the thesis. The scope and approach to the programme of work are then outlined in Section 1.4. A summary of the contents of the thesis chapters is presented in Section 1.5.

1.2 Aim

The overall aim of the work presented in this thesis is to provide a proposal for a method that facilitates an investigation of technology in the home and provides designers with general principles that can be applied to the design of innovative system concepts[3]. The following tasks were undertaken to achieve this aim:

- a literature survey of methods that have been used in the past to study artefacts in the home.
- a literature survey of methods that have been used by designers in the past to elicit requirements-gathering in the workplace.
- an extrapolation of methods from the studies reviewed to assist in the building of a framework for an investigation in the home.
- a study in the home to utilise and evaluate the methods chosen.
- a presentation of findings that provides designers with general principles that can successfully be applied in the design of innovative systems concepts.
- an analysis of how well the methods chosen worked in the home setting
- a comparison of these with other methods that have been used in the home and in HCI in the past.

[3] The term 'innovative system concept' is used to denote a completely new type of device. For example the FLEX project was tasked with building a system which was completely new and that could not be compared against any other comparable device.

1.3 Contributions

This thesis makes two main contributions to knowledge. The first contribution of the work was to provide a novel method that could facilitate requirements gathering in the home with a heterogeneous group of users. The method proposed is called the Home Workshop and it draws mainly on methods that have emerged from Participatory Design.

Having used the Home Workshop in five households, a subsidiary contribution is to offer advice on how to better undertake studies in the home environment.

The second contribution is to provide designers with general principles that could successfully be applied in the design of innovative home systems concepts that will enable researchers and designers to build increasingly user-centred devices for the home. This contribution has been met by undertaking a grounded analysis of the data gathered (approximately 20 hours of video-tape, 25 drawings, and 22 Post-it notes). From the Home Workshops a number of themes have emerged that differ from existing themes highlighted by interaction design and HCI.

1.4 Scope and approach

This thesis demonstrates a novel method for investigating the home that provides designers with general principles that could be successfully applied in the design of innovative home system concepts. As a result of this focus the research presented here is not in the form of a traditional computer science PhD in so far as no system was built and evaluated as part of this study.

This thesis also does not tackle the thorny issue of 'content'. With the advent of digital television and the ever increasing interactivity of devices, the issue of content is of course important and relevant to any future research in the area of home technologies. However, a study of the quality, type, and other issues surrounding content would take another thesis. Therefore, content, while being recognised as an important issue, is not mentioned further in this thesis.

The study was carried out in a small geographic area (central Scotland) and was also limited in that it was carried out in only five households.

This research is concerned with developing methods that would enable a researcher to undertake an investigation in the home that could provide information about a family's current technologies. The method is also concerned with discovering what families want from their technologies in the future, so as to be able to inform the design of innovative systems concepts. Therefore, after reviewing the literature (the results of which are presented in Chapters two and three) it was felt that a workshop in families' homes may be an appropriate method for investigating current problems, orientating participants towards the future (as envisaged by manufacturers) and enabling participants to envision their own ideas for future home devices.

The 'Home Workshop' is the method proposed by this work to provide the data required to enable the main contributions of the research to be achieved. The study took place in five different households in central Scotland, from October 2000 to March 2001.

The Home Workshop method consists of three workshop sessions. The first workshop session investigates current problems using a Technology Tour, representations of emerging technologies and scenarios. The second workshop session asks participants to contextualise ideas for the home in the future, in the form of a drawing. The third workshop session shares these ideas across families, and the participants are encouraged to critique and redesign the designs by modifying and elaborating on them.

The workshops were video taped, some handwritten notes were taken in the first few workshops, and Post-it™ notes were used to collect in-between workshop data. The videotapes were transcribed using conversational analysis transcription notations (see Chapter Four). The data collected e.g. video transcription, hand-written notes, Post-its, and drawings were analysed using a grounded analysis technique.

1.5 Organisation

Chapter one outlines the aims, contribution, scope and approach of the thesis. Chapter two examines what 'home' means to us in the context of this work. Homes have been shaped by technology and in turn have shaped technology. This chapter probes how studies in the home have been undertaken in the past, what they have discovered, and how they could influence and contribute to future investigations in the home. The chapter concludes with a summary of new devices that have been, or were about to be, released on the market in the year 2000, the possible implications of those devices for the home and how they had been researched and marketed. Chapter three focuses, in the first instance, on how HCI and the wider community carry out the design of systems at the moment. It describes what tools, methods and techniques are employed, with particular attention being paid to participatory/co-operative design approaches. The limitations of these methods for undertaking a user-centered design approach to designing new concept technologies for the home will be discussed. The chapter concludes with a review of the methods that could be useful in informing a framework for investigating people and their artefacts in the home. In Chapter Four the methodological framework for the home studies is outlined. How the data were collected is described. The families that were involved in the study and the characteristics of their homes are outlined.

The data gathered from the first session of the Home Workshop are reported in chapter five, ordered by family and method used. A summary is provided of important themes that emerged from the first workshops. Chapter six focuses on the future envisionments for devices that were drawn by the participants in their homes. The chapter then reports on the critique of these visions. The redesigns of the original designs are presented. A summary of the important issues highlighted by these envisionments and critiques is presented. In Chapter seven the analysis of the data is explained. The themes and conclusions from the Home Workshops are presented and discussed. The method used for investigation in people's homes is then reviewed. Finally, the reasons why this method may prove to be a more effective tool for investigating the home than existing HCI methods is discussed. Chapter eight concludes the work and provides a reflective discussion on what the Home Workshops achieved and whether or not they could provide the contribution outlined in Section 1.3. Further, this final chapter offers possible ways in which the work in the thesis could be extended.

2 Homes and their Artefacts

'Houses are much more than physical structures, like the people they contain, houses are dynamic entities which are often thought to be born, mature, grow old, and die.'

(Carsten and Hugh-Jones, 1995, pIIX)

2.1. Introduction

A number of related research areas have converged around the studies of households: these include family studies, audience and sociological studies, and technology studies. The first section below examines what 'home' means to us, then reviews significant technologies and their effect on houses and the people in them. The second section reports on studies which have taken place in the home, that have been interested in the impact of a certain technology in the home e.g. television or home computer, or have been interested in artefacts in the home, and some have been interested in gathering data from the home so as to build new technologies. The chapter concludes by reviewing and appraising technologies that are being suggested for people's homes, now or in the foreseeable future, by manufacturers and the role that market research plays in that process.

2.2 There's no Place Like 'Home'

There are few words in the English language that are filled with the emotional meaning of the word 'home'. The word brings to mind thoughts of family, togetherness and memories. It therefore comes as a surprise to realise that many other European languages have no words with the same connotations. In Italian, for instance, 'Casa' is the nearest equivalent, however, the meaning is much closer to 'house' than to 'home' this is also true of the French 'Maison', and in Hungarian the 'Haz', almost always refers exclusively to the physical structure rather than the emotional space (Csikszentmihalyi and Rochberg-Halton, 1981). There are two words which we would associate today with the word home. The first is an ancient Greek word, '*Oikos'*. *Oikos* meant something like 'household' but (significantly) encompassed all the property associated with the household (land, animals, slaves, tools and instruments, etc).

The *Oikos* was also the economic heart of early Athenian life. Households were self-sufficient; they generated their own resources and contributed to the wealth of the Athenian state. The word *Oikos* therefore includes not just space, as home does, or social networks, as family/household does, or family-oriented work (as domestic does) but all of these and more.

The second word which we would associate with our concept of home and all its connotations, is the word 'Ostal'. The word was used in the middles ages and referred to the basic cell in which a peasant family dwelled and embodied the permanence of a house, the word meant inextricably both family and house (Ladurie, 1979).

The way in which people have personalised their houses is one way they have made their houses into 'homes'. The home could in fact be construed as a craft cultivated by all its members. People have invented ingenious ways to personalise their homes and the artefacts contained with in them from carvings on the beams of a Polynesian hut, to the paintings of a Plains Indian Tepee, or rugs strewn on the floor of an Arab tent. These practices may be related to its material structure, like decorating, cleaning, raising children etc, or to practices of remembering (Bourdieu, 1984).When certain artefacts, rooms, and activities are preferentially selected by various family members to embody different patterns of meaning, then different family members can be seen as inhabiting different symbolic space even though in the same household. So every physical house might contain different 'homes', and the character of these homes might change overtime as the goals and patterns of attention that make up the selves of its members change. The location, shape, and form of our homes can impinge directly on the smallest details of our daily lives. There have been many anthropological studies that have focused on 'the house', that is to say, on the tribal house or on exotic domestic spaces. For further information on anthropological studies of the home, see Cunningham (1973); Douglas (1972); Fortes (1949); and Kent, (1990).

2.3 The Design of the Home Space

In the last 150 years in the industrial world there has been a movement from the majority of households being self-sufficient and agriculturally based to living in towns and cities. This move has had a fundamental effect on families. As Cowan comments, this revolution has transformed the way we conduct our daily lives:

> *Prior to industrialisation the family was the basic social unit. Most families were rural, large, and self-sufficient; they produced and processed almost everything that was needed for their own support. The household is no longer the focus of production; production for sustenance has been removed to other locations.*

> *The number of functions performed are also much reduced, until almost all that remains is consumption, socialisation of small children, and tension management.* (Cowan, 1998, p.34)

The home then is no longer a place of production and is mainly seen as a place for social networks. However, industrialisation was not the only period when massive changes in home took place. The advent of housing estates in the 1960s and 1970s also changed homes, and the way we conducted our lives, quite radically. One of the new concepts for homes in those decades was 'open plan'. The designers and architects of an open plan housing estate in Hounslow thought that by designing the homes as 'open plan' this would make the houses seem more spacious and free-up space. By taking down walls and uniting rooms to make 'spaces' the rooms would become 'areas' with 'spaces' , mapped out according to different activities. The intention was to create an integrated, flexible, and efficient space (Burnett, 1978). However the householders (who actually had to live in the homes) objected to these open spaces because they felt that these spaces lacked 'privacy'. Householders as a consequence altered the homes themselves. The most popular way of doing this was the addition of a wall between the dining and sitting areas and, where the original house plan was of the open plan 'dining-kitchen' type. This was a popular modification in spite of the two small rooms that resulted from the division of an already minimal space. The householders even managed to force a table and chairs into the kitchen even though the architect had deliberately left no room for them (Alderson, 1962).

Modernity in this context was expressed not through the 'open' plan concept of the designer and architects but through the adaptability with which families constructed and reconstructed their surroundings to fit in with their changing lifestyles rather than passively accepting the layouts the design experts tried to impose upon them. This however was not the only case in which architects and designers did not take into consideration the people they were designing for. For example, a major objection to the apartments of the first tower blocks was the lack of space to accommodate kitchen appliances. Prospective tenants were told to keep their washing machines on the balcony and the refrigerator in the hall or livingroom.

This was because insufficient space had been allocated for them in the kitchen as the designers had assumed that the tenants would not own the latest type of kitchen equipment (Attfield, 1999). This resulted in considerable indignation not just because there was a lack of space for these goods, but also because the tenants were told to put the devices in inappropriate spaces.

In 1959 design experts, in the form of the Council of Industrial Design (CoID), were trying to coax the public to adopt modern functional design values. One of the features that proved most intransigent to modernist reform was the primary focus given to the fireplace in the traditional interior. They wished to banish the fireplace to history and the director went as far as to criticise people for not taking up their suggestions. People did not take up their suggestion and in fact the only place at that time to be found with their idealised seating arrangement i.e. no fire and living room furniture orientated around a coffee table was in a room setting designed by them for an exhibition to demonstrate 'good design'. The only real challenger to the orientation of the family towards the fireplace has been television and even it, has not managed to altogether displace the fireplace.

Designers have also tried to show the way a new home should be decorated. For example in a new housing estate in Harlow they showed potential tenants an integral 'scheme' in which colours, patterns, and styles of furniture could be matched in the new homes (Attfield, 1999). However even if the tenants had liked the modern Scandinavian style favoured by the professional designers, they could not acquire them for two reasons: firstly, it was only stocked by a few metropolitan furnishers; and secondly, they could not afford to buy the furniture. The designers however took the lack of adoption as a criticism of their 'scheme' and complained that the layout and furniture was at odds with the design of the home. Their preoccupation with the perfect layout was such that even if a tenant placed a chair diagonally across the corner of a room, this was complained about and seen as completely at odds with the concept of the house. It would be unfair to say that the home owners in these studies rejected the designers suggestions or fought against modern ideas.

On the contrary, the way in which they adapted their home in contravention to the designers' intentions, shows how they appropriated their homes to their own designs.

No wonder, then, that sociologists, social policy analysts, economists, historians, and anthropologists have attended to the design and use of house and home. It is interesting to note, therefore, that builders (questioned as part of a study into the construction of homes in the United Kingdom) said that they built houses for other house builders rather than for the people who were going to buy/live in the homes (Shove, 1999).

2.4 Home Space

'Home as the emotionalisation of domestic space is more than ever a core symbol in Western culture, one that derives its meaning not only from its opposite, the public space, but also from the practices performed on it and in it.'

(Saunders and Williams 1988, p85)

Many researchers (De Mare, 1999; O'Brien et al., 1999; Venkatesh, 1996; Pennartz, 1999; Short, 1999; Csikszentmihalyi and Rochberg-Halton, 1981) have highlighted the importance of spaces in the home. Some of their research and the reasons why they think 'space' is important in the home are highlighted in this section.

We seldom reflect on why the spaces in our homes are arranged in the way they are. This can stop us from asking obvious questions of our surroundings and home space. For example, why do we cover our interior walls and windows? Why is it that we seldom put a bed in the kitchen? Why store the dirty washing in hidden corners in baskets? Answers solely referring to aesthetics, status, privacy, or hygiene are not completely satisfactory.

It is not just the decoration of a room which determines the use of a space or indeed the activities which take place in it, rooms can be determined solely by the specific objects and furniture placed in them. Put a dining table in the room and it becomes a dining room, putting a double bed in a room can make it into a conjugal bedroom (De Mare, 1999). Pennartz (1999) would also contribute that it is not only the nature of the activities, which are shaped by what we put in a room, but also our feeling towards the room and what has happened in it.

This emotion can lead to people feeling comfortable or uncomfortable in different rooms, and rooms having certain 'atmospheres'.

The home is a key site in the social organisation of space, it is where space becomes place, and where family relations and gender and identities are negotiated, contested, and transformed (Short, 1999). Space in the home is something which is negotiated over, perhaps only once when the family move house (this is going to be my room!), or on a daily or hourly basis (Giddens 1984; O'Brien et al., 1999). Therefore, space cannot be seen as a static entity but more as a free flowing expression of the householder's feelings towards that space. A crucial point to note is that the question of space is raised within the space itself- that the householders have points of view on this objective space which is dependant upon their position within it and in their will to transform or conserve it (Bourdieu, 1984).

2.4.1 Public versus Private Space

The issue of privacy and space is of importance in the home, indeed it has been commented that architects often forget that the hall plays a more important role than just distribution. It is not only an entrance room to welcome visitors, but is also a protective and neutralising zone to prevent or ease transition from the public to the private world (Rosselin, 1999). Most hall decorations preserve some neutrality: a neutral wallpaper or plain white paint is often preferred to colourful patterns. On the one hand, this neutrality can be interpreted as a way to allow your guests to take possession of the space: they will hang their coats there and leave their umbrellas to dry. On the other hand, neutrality prevents the visitor from gaining an all-too-personal impression, and in doing so it protects the privacy of the inhabitants (Rosselin, 1999). Front gardens have also been used as a buffer zone in a similar way.

2.4.2 Lack of Space

Lack of space can be a common complaint in the home. For example Csikszentmihalyi and Rochberg-Halton (1981) found, when undertaking a study of the home that even when there were more than two rooms for each person in the family lack of space was still a common complaint.

In contrast, in El Salvador, where 60% of all families live in one room units, people rarely complained about a lack of space (Martin-Barro, 1979). Therefore, perhaps complaints about space or lack of it are not only due to size, because, as commented

on in the previous section, feelings about space are more ephemeral than personal space or size alone. For example the student who created a hallway in his apartment by adding a strip of carpet (Rosselin, 1999), was creating more of a physiological barrier than a physical barrier between the public and private spaces of his home. He was not trying to create a hall way of any great size or magnitude, but a symbolic separation of space.

2.4.3 Ownership and Control of Space

Ownership and control of the home has been shown to be important. Gudman and Rivera (1990) write of contemporary Columbian peasants who showed an almost obsessive concern with issues of thrift and the retention of family property. The home in Columbia is strongly articulated with questions of descent and family continuity. In Trinidad some of the most violent intra-family inheritance disputes take place with respect to housing or land that has virtually no monetary value or potential but rather presents the core family identity and continuity (Miller, 1995).

This leads on to an important question when trying to study the relationship we have with technology in the home: does the amount of control someone has over their home affect the way they use and view the technology within it? Richard (1990) carried out a study of home ownership in a Melbourne suburb, she asked householders the following question: *'why own your own home?'* the main answer given was 'security'. But what did the word 'security' mean to householders'? It seemed to mean control and independence. The negative version of control (lack of control) can be seen repeated in phrases made by the householders *' no one can put you out' - 'If you own, you don't have to worry about the landlord throwing you out all the time* (Richard, 1990, p124).' The positive version of control can be seen in these phrases: *'If you own a house you can do what you want with it - put a nail in the wall, have wild parties,* (Corrigan, 1997, p111).

This issue of lack of control over the home was also highlighted by Miller (1987) he found, during a study of council tenants' kitchens, that there were different strategies available to a household in its feelings of loss of control, one is passive, no effort is made to alter the decoration of the home. The second is when an attempt is made to

draw attention away from the imposed facade by decorating the home in such away as to draw attention away from the fixtures and fittings and towards the decoration and items chosen by the tenants this was also found by Duncan and Duncan (1976) in their study of an Italian neighbourhood in Chicago. These studies would suggest that people feel more in control of their home if they own rather than if they rent it. Further that if a researcher is studying people in homes that are rented they should be aware of possible feelings of loss of control.

In recent years in Western Society we have had much more work on the workplace than the home place and this has led to there being an unbalanced understanding of the world (Short, 1999). Despite recent research undertaken by Venkatesh (1996); O'Brien et al. (1999); and Stewart (2001), this criticism of the lack of studies in the area of the home space remains true. This could be fundamentally important as homes could be changed irreversibly and fundamentally by the technologies being suggested by manufacturers at the moment i.e. the concept of connectivity which is being suggested as a way to facilitate connectedness between individual domestic devices in the home, this concept could impact on issues of control over devices and spaces which have been highlighted as extremely important by the research above.

In a study of American families homes in Chicago, Csikszentmihalyi and Rochberg-Halton (1981) found that when asking parents what space they felt was the centre of the home they cited the living room as the centre of the home, whereas the children in the study would say that their bedrooms where the centre of the home. Perhaps this difference of opinion is due to control of space, in that the adults control the living room space and the children control their bedroom space (at least in theory!). Another reason offered by Csikszentmihalyi and Rochberg-Halton could be the need for privacy as children approach adolescence.

Our relationship with our artefacts also highlights our attitude towards ownership of space in the home. Researchers found that children's special objects were most often found in their bedrooms, fathers' in the basement and study and mothers in the living and dining rooms. As teenagers move into adulthood the location changes from the bedroom to the living room. In old-age this trend is reversed (Csikszentmihalyi and

Rochberg-Halton, ibid). This changing of space throughout our lifecycle perhaps highlights our feelings towards ownership of that space.

How can this ownership and control of space impact on our use of technology? Silverstone and Hirsch (1992) thought that media in the home posed a whole set of control problems for households, such as regulation and control of space. On an everyday level these problems were expressed through decisions to regulate what others: watch, listen to, play with, and use. Technology, therefore, cannot in of itself be studied without taking space, location and cultural perspectives into account.

2.4.4 Studying space

The importance of spaces in the home has been highlighted by many researchers. For example, O'Brien et al. (1999) found that when asking families about a set top box, the majority voiced concerns about the home as a socially organised environment and made little comment about the problems they may have had with the technology under discussion. They conclude that we currently lack a clear understanding of the relationship between technological artefacts, the nature of the spaces they find themselves in and the activities that take place within the home. Therefore the finding by Sarela-Oksanen (2000), that the technological space is encroaching on the social space as more and more everyday activities are carried out via a technological mediator (i.e. tele-everything: shopping, banking, working, health services, and socialising), is of significance when considering the development of future technologies for domestic environments.

One way of studying technology assimilation in the home is proffered by Venkatesh (1996). He noted a lack of critical understanding of space, and no sound theoretical or empirical base from which to observe and analyse these spaces.

Venkatesh viewed two spaces in the home as being important indicators of the use of home technologies in terms of two main interlinked components- the social space; which is constituted by the social structure of the household and the activities performed within the household. And the technological space; which represents the nature of the technological environment within the household. A schematic representation of these spaces is shown in Figure 2.1.

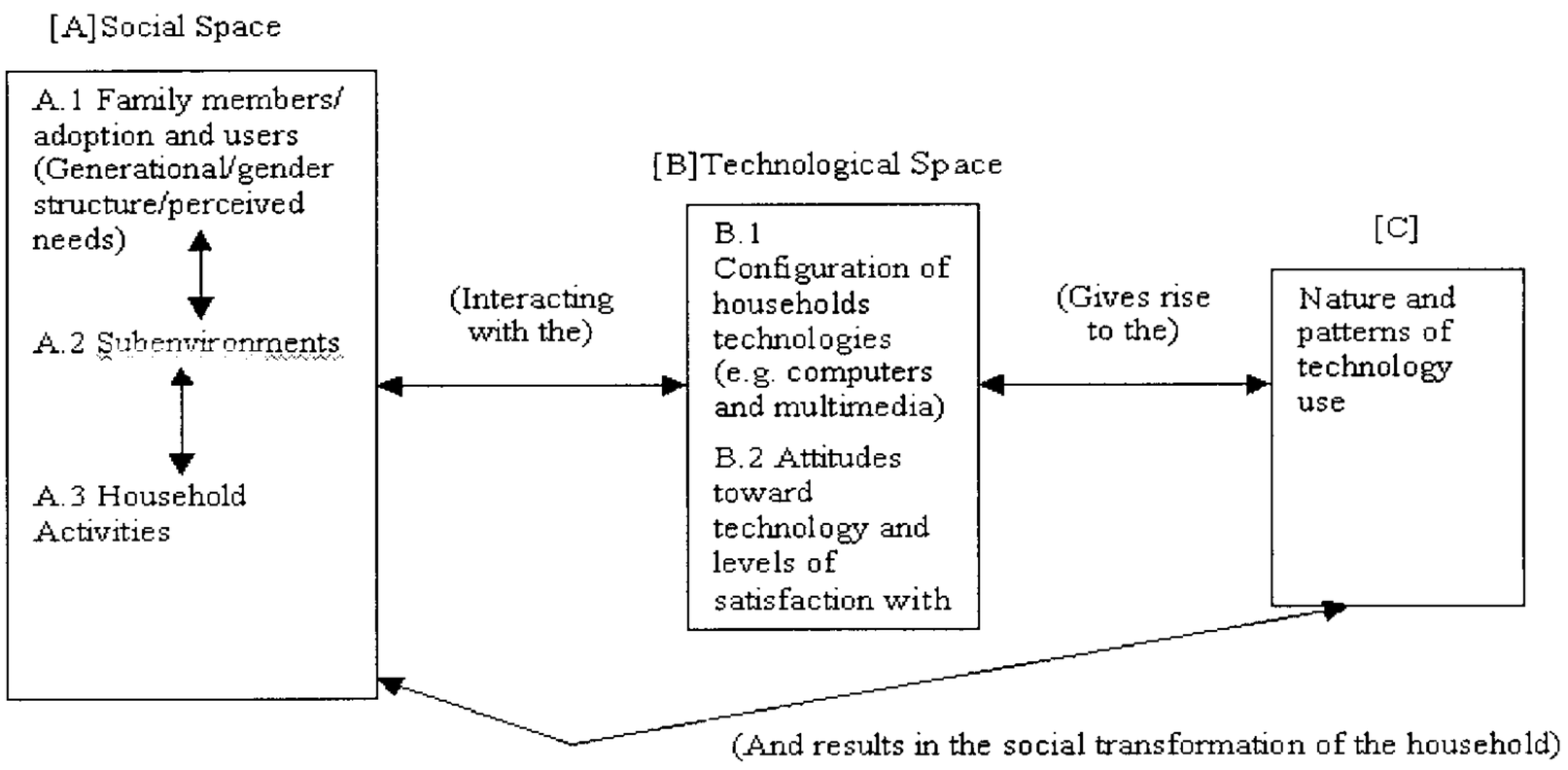

Figure 2.1: A schematic diagram of the relationship between the social and the technological space. (Venkatesh, (1996, p51).

Venkatesh identified in his model the social space consisting of:

A.1 : Who was most likely to adopt and use certain technologies (children or parents)

A.2 and A.3: the sub-environments and activities which were targeted for technology use e.g. food management (meal preparation), household maintenance/finance (cleaning), leisure/entertainment (watching TV), communication (telephone conversations), work (telecommuting) and family development (adult education).

The technological space consisting of:

B.1 Technologies primarily used to carry out the activities. For example the activity of food management could utilise: kitchen appliances and an automobile.

B.2 The family members attitude and level of satisfaction with the technology being used to carry out an activity.

He said that a study of these two areas could highlight patterns of use and could help to identify the successful or unsuccessful adoption of a technology. He gives the example of how the computer in 1980s was viewed as a work tool and was not assimilated into the social space, however, with the advent of e-mail and the internet this changed and the computer was assimilated more into the household because of its new utility as a communication device. Venkatesh work is important as it gives a researcher a framework within which to study a household's use of technology and

the possible implications of this use. It was felt pertinent therefore to be aware of the spaces highlighted by researchers in this section.

2.5 Gender in the Home

This section will summarise studies on gender that have specifically dealt directly with technology and the home. For further studies on gender and the home see: Hennon, 2000; Fraad, Resnick, Wolff, and Norton, 1994; Cockburn and Dilic, 1994, amongst others. In the studies reported here technology was found sometimes to be designed with biases in mind and that technologies were sometimes specifically designed to disadvantage women.

In the past Cockburn (1985) argues men have designed to disadvantage women. She puts forward the example of the printing press in the late 1800s a new press was used at first by both sexes. However this did not suit the male printers, so the printing press was modified so that heavy manual lifting was required, thereby excluding females. Designers of a microwave oven, were also found to be biased in their ideas of what men and women would be interested in when it came to purchasing a microwave oven. The designers thought that a woman would be interested in the aesthetics, and a man in the technology. However field studies revealed that the rationale for buying a microwave was similar if not identical, between genders (Omerad, 1994). This study shows that designers should by wary of assuming the proclivities of men and women.

The level of a woman's education was found to affect who used what technologies in the home and more importantly the control over the use of the technology. For example, research carried out by Smeds (1994) found that during a study of the use of a new vacuum cleaner the higher the education and income levels of the female participants, the more the household tasks were shared.

A separate study carried out by Haavio-Mannila (1984) made a similar finding: that relative educational and financial resources of partners are important determinants of the division of labour in the family.

Omerad (1994) found that there can be bias in the design of a technology, but does this bias have any affect on users? Rogers and Williams (1986) have claimed that new information technologies, especially computers, have caused gender inequalities,

and even reversed some of the women's gains in the workplace. It could be argued that with more and more technology migrating into the home a similar reversal may take place in the home. It should be remembered however, as Cockburn points out, that manufacturers are not always interested in who will use the technology: *' The manufacturer-designer of an artefact is sometimes frankly uninterested in who will buy it and what their needs are, he will rely on an advertising campaign to create a market, his main concern is how cheaply the artefact can be mass-produced.'* (Cockburn, 1992, p38).

Cockburn claims that men and women see the home in different ways men see the home as primarily a place for leisure, women see the home as primarily a space for work then for leisure (Cockburn and Omerod, 1993). Therefore any research study undertaken in the home should recognise that a bias may not be the designers or the manufacturers, but the gender biases of society or the individual householders.

2.6 Significant Household Artefacts

This section reflects on the impact of the more significant household artefacts: electricity, telephone, television, the home computer, and the internet. This section reports on studies that have been undertaken to elicit information about why these artefacts have been acquired, how well they have been assimilated into the home, and what affect these artefacts have had on the layout of the home.

Electricity is a naturally occurring phenomenon that has been harnessed as a home utility which has enabled other technologies to be invented and acquired.

The appearance of electricity in the home facilitated the 'mechanization of the household', i.e., the growing substitution of human or female labour by technical artefacts' this has had radical consequences for housework and the layout of the domestic space (Lupton, 1993). The way the home was structured also changed as electricity brought with it the ability to heat water cheaply; this meant that bathrooms started appearing in new homes. The primary focus for most of these new devices in the home was labour saving. The kitchen was the main locus for most of these changes in the home, due to the growing scarcity of maids and the growing knowledge of bacteria and the way disease was spread. The new technologies for the

home where mainly focused on the kitchen e.g. washing machines and electric/gas cookers. This was followed by the introduction of small electrical devices, such as the electric iron. Although women appreciated the coming of the washing machine, the washing machine itself failed to be assigned a specific place in the home. Also, the journey of the laundry through modern living space does not accord with principles of architectural efficiency and household rationalisation. The storing of dirty laundry, the washing, the drying, and the ironing and folding, as well as the storage of appliances related to laundering are relegated to empty corners of different rooms. Architects seemed to reduce the laundry process to the installation of a washing machine, discreetly hidden in the built-in kitchen or in the bathroom, neglecting the processes of collecting, drying, and ironing. Washing, therefore could be said to be the nomad of the modern home.

The advent of refrigeration was also important in the home. Early fridges came with wood panelling, however, this soon changed to white. This was because the idea of cleanliness started to be associated with whiteness, this concept soon spread to wanting kitchens to be lighter and brighter, all the better to see the dirt and germs! The fridge was re-designed to fit this new image of cleanliness (Corrigan, 1997). Fridges in some parts of the world have the ability to convey social status. For example, the new city houses of Hyderabad in India often contain refrigerators in the dining room for guests to admire (Duncan and Duncan, 1976). Therefore, a domestic appliance can also in certain settings be a status symbol much in the same way as the objects were in the Csikszentmihalyi, and Rochberg-Halton (1981) study.

2.6.1 Telephone

The initial marketing of the telephone was aimed at the business community. Later however, when telephone companies realized how the telephone was actually being used, the development and marketing plans changed to encompass residential areas as well. There are three particular areas of early telephone use that are of interest to this research. Firstly, the advertisement by telephone companies of optional services, such as shopping: *'Women Slaves! Enough about household duties and cares without being obliged to run down almost daily to the shop for supplies, a telephone would save her time and energy and cost but a few cents a day.'* (Martin, 1999, p52).

Secondly the telephone companies emphasis on peace of mind as a way to sell telephones, they did this by making it clear how easy it was to summon the assistance of the police or doctor if you possessed a phone. Finally, the use of party lines created a need for the telephone, the operator would be asked to connect two or three lines and hold them open so that a group of women could talk back and forth (Martin, 1998). Therefore, the phone was advertised as a labour saving device (shopping), a way of summoning emergency assistance (doctor, police), and finally as a multi-party communication device. In a recent study by Lacohee and Anderson (2001) in which a study was conducted of consumers use of the telephone, they found that peoples use of the telephone in the home is not only a matter of utility, function and ease of use, other factors influence usage as well, such as: comfort, lifestyle, life stage and gender.

2.6.2 Television and Entertainment Devices

Television has been one of the most powerful media of the modern world. The massive growth in television came about during the 1950s and 60s. Many studies have been carried out on families use of television (Lull, 1990; Morley, 1986; Silverstone, Hirsch, and Morley, 1992) and the impact of this on family life and how the technology has been socially shaped around the family's social organisation.

Morley (1986) found that there were the following major themes dominating the use of the television: power and control; planned and unplanned viewing; and guilt.

The power and control issue is important when taken in context with one of his other findings; that the higher the level of the mother's education, the more power and control the mother had over the viewing habits of the family i.e. type of programme watched, and time spent watching the television. They also found that people use their television in ways other than actively watching. For example, Lull (1990) found that people used their television in two main ways:

- environmental usage (provision of background noise, companionship, and entertainment), and
- regulative (punctuation of time and activity, talk patterns).

O'Brien et al. (1999) and Bausinger (1984) made similar findings. They found that, television consumption is an integral part of the routines and rituals of everyday life,

and is constantly interrelated with other activities such as talking, eating or doing housework. Finally, television consumption is not a private, individual process, but a collective, social process. Researchers also found that though television is often seen as a distraction, interfering with the communal aspect of family meals, it can also provide a collective focus. Families enjoy the sense of being together, sharing a favourite program or videotape and can be seen as a helper to the mother and as a punctuation of time (O'Brien et al., 1999).

Haddon (1992) cautions that we should not study the use of information communication technologies (ICT's) or computers in the home. His reason for this is that we also use ICT's and computers in the workplace and, therefore work based studies would provide all the information required about use. This would be a tenable argument if what we wanted and expected from a computer or ICT in the workplace was the same as it is in the home. However, this is not always the case, there may be functions that are appropriate and welcome in the workplace that are not welcome or wanted in the home. Therefore, to get a truly accurate picture of how a technology is used one must, as Morley and Silverstone (1990) suggested, study it in the context in which it will be used.

The above research found that families' (or more accurately parents, as in all of these studies it would seem that only the parents were interviewed) use of television and their viewing habits are heavily influenced and segmented not just by gender, but by role and socio-economic grouping. The findings from these studies have raised many issues around the concept of television and its use in the home. It can only be conjectured that some of these issues may be found relevant to this research e.g. control, bringing together of families, etc. This may be a perfect time to be studying our relationship with technologies and television as our relationship with television is set to become more complex with the advent of digital television.

2.6.3 The Home Computer and the Internet

This section investigates the findings of various studies on the use of the personal computer (PC) in the home. The section starts by looking at some early studies of the adoption and use of computers in the home. Then explores whether the PC has ever

really become a 'home' computer in a broad sense. Finally the importance the advent of the Internet has had on the home computer is discussed.

A Brief History of the Personal Computer in homes

Home computers were sold to people in the 1980s as a way of working at home, to help educate children, for word processing, and generally equipping yourself and your children for the future. However, enthusiasm for this idea levelled off. Researchers found that some of the reasons for this were that there was not a functional need for a computer in the home (except for a small minority of people), the word-processing function could be equally well performed by an expensive typewriter or dedicated word processor, and the video games function could be fulfilled more cheaply by a home video game machine (Caron, 1985). Because of this the families that had bought computers in the 1980s failed to trade-up to more sophisticated models, when they became available on the market e.g. Amstrad's PCW IBMs home computer, BBC Micro, Sinclair Spectrum and Dragon 32. Murdock, Hartmann and Gray (1992) thought that early disillusionment had affected the views of householders.

They quote one of the householders they interviewed:

'I don't know really why, because it suddenly started didn't it, computers everywhere. The first one I ever saw the [Sinclair] ZX81, which I thought was really good when I first saw it. It's nothing really is it? Because it can only print the name on the screen.'

And another: *' I wanted it as a word processor, but of course its no good for that at all. I didn't appreciate it at the time. You can't get enough words on the screen, unless you get one that's about four or five times the price...I wanted it for a word processor and they said (the shop assistants), "Oh yes they can do this" and "Oh yes they do that", you know. And of course it does, but not satisfactorily for proper use.'*

(Murdock et al. 1992, p.148)

The above research highlights clearly why people were disillusioned with the early computers they bought, as the PC quite singularly failed to live up to the marketing hype and was not robust enough to perform the tasks that were required of it e.g. word processing. Another reason for failure was highlighted by Silverstone et al (1992). They commented that computers had failed to find a place within the moral economy of the household, specifically in terms of its incorporation into the routines of daily life. This failure is discussed in the next section.

The 'Home' Computer

One of the comments made about PCs in the home is that they have failed to be completely assimilated into that environment (Venkatesh, 1996; Silverstone et al., 1992). One reason could be that the PC bought for the home place has, until quite recently with the advent of iMacs, looked exactly the same as computers in the workplace. PC manufacturers, therefore, did not act in the same way as Singer (see end of section) and try to redesign or remodel the PC so that it would be better assimilated into the home. The PC then is still a stand-alone unit that has come from an industrial/business background, and unlike other technologies in the home, has not been specifically built to either carry out a task in the home, such as cleaning floors, or entertain. Another suggestion has been that the PC is too complex a machine for the home. Rubin commented that unlike other technologies in the home: *'Learning to use a computer is much more like taking up a musical instrument than following instructions on how to use an electrical appliance, such as a toaster.'* (Rubin, August 1983).

However, past research would suggest that people do not use their PCs in complex ways, for example, Caron (1985) found that people in the home only used their PC for word processing and games. Similarly Kraut (1996) found that people mainly used their PCs for games and email. Their research suggests that people use and have historically used their PCs in the home in quite straightforward and uncomplex ways. Therefore, it cannot be assumed, that just because people are using a complex machine they are using it in a complex way.

In conclusion the poor assimilation of the PC into the home cannot completely be blamed on the complexity of the machine. An alternative suggestion, as to why the PC has experienced poor assimilation, is that people in the home are unsure of where to place it. During their research, the team at CRITO (Center for Research on Information Technology and Organizations) (Venkatesh and Vitalari (1986); Venkatesh, (1996); Venkatesh, Shih, & Stolzoff, (2000)), found that in the 1980s the personal computer, although in the home, had not become a 'home computer' and had not been integrated into the home in the social context. They thought that there might be several possible reasons for this: people viewed their home computer as an

extension of their work computer; software for home use was not well developed; no telecommunications connectivity; inapplicability and inappropriateness of the industrial/business model for the household; and a lack of computer skills amongst the general public. Subsequently, the adoption of PCs grew quickly in the late 1990s, according to Venkatesh because there was a new generation of young adults who grew up with PCs, more manufacturers targeted their software towards the home market, and PCs had acquired communication capabilities. The importance of these new communication capabilities are discussed next.

Internet

The impact of the Internet on home computers cannot be underestimated. Kraut (1996) makes a particularly interesting comment about how the internet capabilities of the computer, which had evolved in the business place, was being marketed to the home.

He compares this with how the telephone was at first marketed for business use and then later in the home: *'Manufacturers of the telephone did not foresee that many different types of people would like to talk on the phone for its own sake and not to accomplish a task, but because they enjoyed talking to other people.'* (Kraut, 1996, p34). He comments that how banks, phone companies, and computer companies insist on selling computers and online services to consumers for telecommuting, home banking, and home shopping, seems to echo the early misunderstanding of the use of the telephone, as the main use for the Internet in the home is personal communication (Kraut, 1996). Venkatesh (1996) made a similar finding commenting that business people stress the mass media features of the Internet and its ability to broadcast information, entertainment, and advertisements to a large population of consumers. In contrast, people at home value the Internet for more personal uses to maintain social relationships and to participate in their local communities.

In conclusion some technologies in the home have been built solely to be used in the home, however, other technologies such as the telephone, were at first marketed to businesses only; it was only later on when the phone companies realised that the phone was being used in a social context that they started to encourage and advertise social use of the phone. The phonograph was also seen as a business tool at first.

Edison (the inventor of the phonograph) thought that the main use of the phonograph would be as a business tool to record memos, letters, and other types of business correspondence, and then send them to other businesses (Johnson, 1997). This as we all know was not what the phonograph ended up being used for. The main use for the phonograph was to record music, so that people could listen to music in their own homes.

The sewing machine is an interesting case of when a manufacturer completely changed the look of the machine so that it would be accepted in the home. Sewing machine manufacturers were faced with a massive drop in sales. A possible market that had not been sold to before was the home. It became an economic necessity, therefore, to turn the sewing machine into a domestic appliance, but this was easier said than done. Initial attempts were not too successful, partly because they were expensive.

But cost was not the only factor, for the industrial connotations had not quite been removed. As Forty put it, *'It was like having a machine tool in the living room'* (Forty, 1986, p96). The manufacturers realised that unless they created the impression that the place for a sewing machine was in the home, the market was never going to accept the machine.

The manufacturers first of all tried to advertise the machine by placing it in the setting of the parlour in a picture, however, this did not quite convince people to buy. One manufacturer, Singer, decide to go a step further and design the machine to fit into the home setting. They did this by making the machine smaller in size, lighter in weight, and giving it a more elegant design (Forty, 1986). This led to massive sales and to the acceptance of the sewing machine in the home.

It could be concluded from the problems with the assimilation of the PC in the home, that Venkatesh (1996) was correct when he said that technologies that were built to be used in the home from the start where more likely to succeed than ones which had been taken directly from the workplace into the home without any modifications. Another logical conclusion is that computer manufacturers in the 1980s and 1990s

failed to do what Singer did and redesign the PC to suit the home environment. A notable recent exception is Apple Macintosh's i.macs.

In conclusion the home was redesigned for electricity and sometimes technology is redesigned to fit the image of the home. Therefore the final design of a technology is not always in the hands of the producer/manufacturer but also in the hands of the user and the surrounding ideals of society.

2.7 The Social Shaping of Artefacts

This section explores artefacts and their symbolic value. The reason for looking at artefacts in the home is that the reason for keeping a technology in the home may not solely be due to its functionality. Therefore clues from past studies as to why artefacts are important in the home and how they are shaped by householders may provide significant insights into a technologies relative importance in the home.

Artefacts, even industrial products, are not neutral in the ordinary sense of the word, i.e. independent of the interest and tastes of those who perceive them, and they do not have a universal, unanimously approved meaning (Bourdieu, 1984). An artefact cannot always be viewed objectively because of the possibilities and impossibilities it offers, which are only revealed in the world of social uses, including, in the case of a technology, the use or function for which it was designed.

Some artefacts are ambiguous in that they are carried around with us and are therefore not 'work' or 'home' artefacts, such as the personal stereo or mobile phone. Many people at first were uncomfortable with the concept of the personal stereo because it did not have a place in the social order (Corrigan, 1997).

Some researchers think that we do not have the same relationship with artefacts now as we did historically. Corrigan, for example states that:

> *The majority of families today are free of both the crushing weight of history and the security that an enduring familyness of objects would bring (artefacts handed down through the generations). The nuclear family uses goods more to produce itself as a family on its own, isolated both from the world and from kin, with no relation to ancestors or descendants.* (Corrigan, 1997, p42)

Are we now so separated from our past and families that we have nothing in our homes that have been inherited or given as a present (as one thinks that these types of

artefacts also have a value that goes beyond the value of the artefact itself)? Many of us have something in our home not because we like it but because it holds sentimental value or was given to us as a gift. As Baudrillard commented:

'An object understood in terms of its functions has a very practical relationship to the world: a clock, for example, tells us the time. But an object understood not in terms of its functions but in terms of possession can become quite a different thing. The clock may still tell the time, but the fact that it is my clock gives it a different dimension. Maybe it was a present from someone, or maybe I collect clocks. (Baudrillard, 1990 [1968], p48)

It can be concluded from this that a study of home technologies would discover technologies in the home that may not just be related to in terms of their functions. The issue would be how to get at those meanings.

In relation to this some researchers have complained that when it comes to artefacts in the home sociologists and other researchers have paid very little attention to the interaction of individuals with their artefacts. And that as a consequence of this we know very little about what individuals actually do with the goods they purchase (Campbell, 1995). Therefore how can this research begin to find out why people acquire the technologies that they do and what affect that technology has on a household? An interesting and informative study of artefacts in the home and their possible meanings/value to family members was conducted by Csikszentmihalyi and Rochberg-Halton (1981). Their study investigated the meanings of domestic objects: 82 families living in the Chicago metropolitan area, half being described, by the researchers, as upper middle-class and half lower middle-class, were asked: 'What are the things in your home, which are special to you?' This resulted in 1,694 objects, which they classified, into a number of categories. The main ones were: furniture (36%), visual art (26%), photographs (23%), books (22%), stereo (22%), musical instruments (22%), television (21%) and sculpture (19%).

One of their findings was that furniture was more or less important depending on your stage in your lifecycle.

Another of their findings was that our experiences with objects are mediated by three modes:

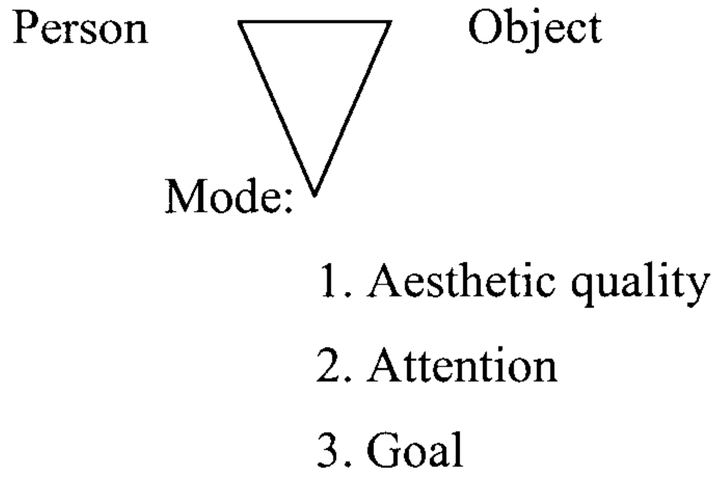

Figure 2.2: Our Experiences with Objects (Adapted from Csikszentmihalyi, and Rochberg-Halton, 1981, p176).

It was thought highly probable that these three modes would also be found to be mediators in the participants relationship with technology.

Silverstone, Hirsch, and Morley (1992) also undertook a study of people and their objects in the home. In their study they found that the history of an object could be traced throughout its lifecycle in the home. They found that this tracing can give a researcher information about the moral economy of the household as well as raise questions over age and gender, as well as questions of the visibility or invisibility of technologies within the household. They also comment that families will fight over certain pieces of technologies and that control over a technology is important. They further noted the importance of the location of a device in the home. Therefore Silverstone et al. (1992) think that the location of a device is important, Venkatesh (1996), thinks that how a device is assimilated into the social space is important and O'Brien et al. (1999) think that the social organisation and space is important.

Artefacts are not always used in the way a designer intended. Artefacts can in fact be used in ways not even contemplated by the designer. An artefact, therefore, is socially shaped. Sturesson (2000) makes the following comment: *'Technology is shaped not only during the design process, but also after it is taken into use. The artefact is not always used according to the expectations of the designer, it is subject to 'domestication' into households.'* (Sturesson, 2000, p100). Johnson (1997) points out

that when a product is about to or has a limited release, all types of distortions and misunderstandings are bound to appear. Misunderstandings not only of how the machines actually work but also of more subtle matters: what realm of experience the new technologies belong to and what values they perpetuate. Du Gay et al. (1997) also found these misunderstandings were present when the first Sony Walkman was built. The first Sony Walkman had two plugs for headphones so that people could listen to the music from one device together. However this was not what happened in real life and the second plug was not used.

Du Gay also argues that artefacts always tend to have 'identity' value and not simply 'use' value. He gives the example of the Punks' use of safety pins (Du Gay et al., ibid). This was not, one would assume, the original intention of the designers. It could also be concluded that the TV as 'babysitter', was not the intention of television manufacturers, but it is a use of the television nevertheless. This identity value can have an affect also on whether a device is used or not. For example Hirsch et al., (2000), undertook a study of elders' use of devices in a residential care village. They discovered that some of the elders' would not use their motorised wheelchairs, as they found them aesthetically unpleasing.

A majority of the elders were in the process of acquiring or trying to buy a motorised scooter as the elders felt that the motorised scooter looked more sporty and fun and as a consequence felt more comfortable using them. Their study showed that even though these two objects offered exactly the same functionality one was preferred over the other solely on the basis of aesthetics.

What implications does this have for the design of devices or systems? It could be suggested that it may have an effect on the size, shape, features, functions and quality of device purchased. For example is there any point in designing an artistically significant interface for emailing through your TV if no-one uses it (97% of the people who can email through their television choose not to do so (Towler, 2001)? It may be better not to include the email facility at all and instead add a feature that users feel would be of benefit.

The use of a technology and the evolution of the subsequent designs of the technology are therefore not always in the hands of the designers but sometimes in the hands of the users. Just one among many possible reasons to justify involving users in the design process.

2.8 The Future for Devices in the Home

'Far from being a marginal arena, the home is a key location for our experience of IT, and for the success (or otherwise) of specific IT products. Domestic leisure as we now know it is inconceivable without an extensive range of IT devices. Rather than being marginal, or 'not real IT', these devices are absolutely central to IT markets, IT developments and our daily experience of IT.' (Mackay, 1995, p267)

Mackay carried out a study of people's acquisition of the following devices: telephone, television, videocassette recorder (VCR), home computer, computer games console, and compact disc (CD) player. He was interested in these technologies because he thought that they were becoming more and more connected and inextricably linked. He concluded from his studies that:

'The growth of such media as PCs, games consoles, and CD-Players, together with falling television audiences, would suggest that there is consumer demand for interactivity. ' (Mackay, 1995, p267).

The scale and significance of this shift should not be underestimated he said because: *'for a whole generation, video games have superseded popular music as the main form of entertainment.'* (Mackay, 1995, p268). From this it could be concluded that manufacturer and designer should understand:

- What technologies people want to be able to connect together.
- The level of interactivity they want.
- How to provide these services via the device (perhaps through the infra-structure of the web).

The importance of these issues and the technologies which will result from this ever growing interactivity cannot be underestimated, as these technologies will be combining the power of a computer with the latest communication technology.

Unless the user is consulted on the design and functions of these technologies, they may well be left as the outsider. The next section will asses how manufacturers are meeting this challenge at the moment.

2.8.1 Emerging Home Technologies

This section reviews the more recent efforts of technology manufacturers to design and build new devices for the home. The reason for undertaking this review was to understand how other researchers and manufacturers were designing and building technologies for the home at the present time. The main body of research reported in this chapter, so far, has focused on more well established technologies; therefore, it was felt a review of the latest technologies on the market would make a contribution and help to focus the research direction for the current work. The products were found by:

1. Reading newspapers, trade magazines, and online news sites, such as: which, Business Week, electrical retailers, BBC online, Guardian Online, Computer Weekly and The Financial Times.

2. Searching the web for new products from technology websites, such as: Wired, The Biz.

3. Searching manufacturers' websites, such as: BT, Hoover, Hotpoint, Sony and Philips.

4. Searching research centres websites, such as: MIT, Cambridge AT&T.

Any new devices found and thought to be of interest were investigated further. An artefact was deemed to be of interest if it included new features and those features could be said to include a requirement for a higher level of interaction than was previously the case. For example: the availability of a microwave in a new range of colours would not be investigated further, however, if email or a radio had been incorporated into a new microwave range this would be investigated.

The main search for the devices in this section was undertaken in 1999; however, periodic updates have taken place since that time.

The majority of new technologies being launched by manufacturers were found to be existing products that had been adapted to offer new features (see appendix 1 for some pictures of the products found and a list of their features). Many of the new

services that are being launched in this context are already in use i.e. email (out of 9 devices 8 offered e-mail) and the Internet (out of a possible 9 devices 6 offered internet access). These technologies already exist and are popular; therefore the risk of adding such a service to a new device is small. In fact, the adding of these services could improve customer loyalty as one mobile phone company, SFR, discovered (Elstrom, 1999). However, what does this mean for the user? It could mean that users will have the flexibility of being able to use more than one device to carry out a task. For example, sending an email to a friend via your mobile phone on the train rather than having to wait until you are either in the office or at home. The ability to multi-task e.g. while cooking your chicken curry in the Microwave, you can carry out all your banking transactions. However there are many problems with these devices, for example, the 'new' services they offer are already well serviced by existing services and products such as television, radio, newspapers, special interest magazines and telephone services. Therefore the user is already well served by the technology and methods they currently use and may not want to change. People, much to the chagrin of manufacturers, do not always feel the necessity to buy the latest technology being offered: *'They may feel quite content with the manner in which their present products meet their needs and hence fail to be attracted by the 'extra' which the 'improved' product offers* (Campbell, 1992, p54).' One of the ways manufacturers have of minimising this issue is by using a 'Trojan horse' effect e.g. people will buy a television for traditional television content, and get interactive services sneaked into their homes via the backdoor (Stewart, 1999; Noll 1992).

Also manufacturers do not always want the consumer to decide and simply do not offer the consumer the choice between the old and the new improved product as the former is simply replaced as a product line by the latter (Campbell, 1992). One of the reasons for this strategy could be that it minimises the risk taken by the manufacturer as research has shown that there is an unwillingness to pay for new devices (Bryant, 1997). Most manufacturers rationale seems to be that the consumer is going to buy a new microwave, television, phone, or fridge anyway so why not the new interactive one? However, this strategy does not always work. The editor for Guardian Newspaper online, Neil McIntosh (2002), recently wrote an article saying that he was

dumping his new Psion and acquiring a Filo-fax paper-based organiser. He said that he always enjoyed exploring the worlds of organisation and productivity each subsequent version of PDAs from various companies (Psion, Compaq, Palm) offered. However, the reality was not as good as the marketing hype, he in fact found that they rarely delivered and constantly needed to be sent for repairs.

The idea that a product with fewer features might be more usable, more functional, and superior for the needs of the customer is not always, therefore, considered by the manufacturers. This can be seen to be the case in a report by the EC's European Foundation for the improvement of Living and Working Conditions. It criticised manufacturers' lack of effort in studying home life and the implications of new technologies. After discussing initiatives in the US, Japan and Europe, the report commented: *'A major criticism can be levelled at all three. No model of the home or its users has been developed which could underlie developments in the electronic home area. The initiatives are largely the result of a 'technology push' type approach. A clear conceptual paradigm has not emerged.'* (Moran, 1993, p57)

Where does the inspiration for new products then come from at the moment? Manufacturers often find inspiration in competitors' products. They scan their competitors' products for problems and try to find ways to improve or solve these problems. They also think of ways of adding new functionality (Miles et al. 1992). Therefore it can be seen that manufacturers sometimes are more interested in what their competitors are doing than providing a better more usable product to users. Another strategy of manufacturers is of course to mount an aggressive advertising campaign, which tries to persuade users that they 'need' the new device.

Sometimes, however, manufacturers do have a completely new product and do need to attract new users. So how do they go about attracting these new users? Norman (1999) commented that most manufacturers market in the first instance to early adopters, people who buy because they are in love with technology and will buy almost any new item, or whose need for the newly developed functions are so great that they are willing to put up with any other problems. According to Campbell (1992) there are many different types of early adopters and they adopt the newest devices for different reasons. For example there are those that crave the fresh and

untouched, those that are attracted to new innovations and those that crave the novel or the bizarre. Campbell's work shows that appealing to all possible early adopters could be very problematic if not impossible for a manufacturer. Another hope manufacturers have is that people will buy the new devices for the symbolic value of ownership, as Corrigan (1997) states: *'the symbolic use-value of a self-purchased Armani jacket may have little to do with its connection with keeping warm'.* (Corrigan, 1997, p34). Therefore, it may be that people buy a new device for the symbolic value, and do not use the extra services or functions, such as the Internet or email facilities provided.

Culture also plays its part in directing consumers to pay attention to new attention-getting devices rather than to the specific functions or qualities of the devices themselves (Csikszentmihalyi and Rochberg-Halton, 1981).

Shopping

Many of the future devices surveyed included the ability to shop from home on the Internet: these provide a compelling illustration of the potential cultural constraints on new domestic technologies. Some studies on shopping and how it has evolved to its current stage have suggested that shopping is a highly evolved leisure pursuit. For example, Corrigan (1997) claims that the advent of department stores and later shopping centres provided a new female space in the public sphere. Other researchers have made similar claims. One writer went as far as to maintain that *'The department store made the phenomenon of a feminine public possible'* (Barth, 1980, p80). Laermans (1993) went even further and suggested that for women, shops are the equivalent of male clubs. These studies show that shopping is not just a task, but also a leisure pursuit, especially for women. Women also seem to view shops as inherently pleasant and safe places to visit. Haddon (1988) discovered that mothers did not feel that computer shops had the same corrupting influence as games arcades even though the children carried out exactly the same activity in the shops as they did in the arcades. It can be seen therefore that shopping while a task is also a social event. In the past the washhouse was a place were women carried out a task but also socialised. In 1855 Napoleon III instructed his architects and planners to build a prestigious wash- and bathhouse in the Temple Quarter. The building housed the

most advanced technical achievements in laundering. However, six years after its opening the laundry was closed. The reasons for this were that the women had to undertake their washing in silence and in individual cubicles; this led to a female boycott (Cieraad, 1999). The architects and planners of this project failed to see the significance of the social aspects of laundering for women. This very same mistake could be being made by designers and manufacturers of home devices in that they are simply treating shopping and other tasks in the home in the same way as they treat tasks in the workplace i.e. as just another task to computerise.

Usability

Some of the devices being put forward by manufacturers could have one or more usability problems. A microwave, for example, is usually situated on a workbench in the kitchen; this is perhaps not the best or most comfortable place to type an email, as most of the population would have to crouch to see the screen. Some of the mobile phones have been criticised in magazines for being bulky and difficult to operate (Elstrom, 1999). Sweeney (1997) criticised this failure by manufacturers to think through the usability of their products, by citing the example of a new cable television service: *'It would take the user 42 minutes at 5 seconds per channel to navigate through all the 500 hundred available channels.'* (Sweeney, 1997, p5) Sweeney's work demonstrated that few users have the time or the inclination to check through all the available channels.

Most of the products being proposed by manufacturers are not following the concepts put forward by Norman (1999). Norman said that, '*When we are designing information appliances we should follow three axioms: simplicity, versatility, and pleasurability.*' (Norman, 1999, p102). It would seem that manfacturers are more interested in either what their competitors are doing, or being the first to launch a product on the market place than trying to make the device more usable.

One of the main usability goals is Learnability: the ease with which new users can achieve effective interaction (Dix, et al. (1993). How do people set about learning to use a new technology in the home? It would seem that people have little patience for learning how to operate new products in the home and, will not bother to consult the

user manual; they expect interfaces to be self-evident (Monageg and Wagner, 2000; Carroll and Rosson, 1987; Neilson, 1993). Even those with computer skills have very different expectations when they interact with a new device for the home. People are not willing to spend time trying to learn about new devices and similarly they do not want to spend time in installing or setting up the device. There are additional problems with home devices in that they may need to be installed more than once (e.g. if the user moves home, or needs to update the device) and more than one person will be using the device (as it would be an unusual home appliance that was only ever used by one person, even in the case of gendered appliances such as washing machines, other members of the family on occasion do use them).

Monageg and Wagner (2000) warn that interactive devices need to provide continuous feedback otherwise the user will feel lost. If devices are not perceived to be responsive, users can become annoyed, often repeatedly pushing buttons, and/or assuming the device is broken. When users become frustrated they commonly stop using a device. The devices surveyed were being evaluated in the manufacturers laboratories. Could the lack of discussion about how people learn to use their devices in the home be due to the fact that the study of home appliances generally takes place in laboratories, instead of being assessed in the context in which it will be used?

Manufacturers are hoping that we will adopt and use these new devices but what if we don't want to interact in new ways with our washing machine, fridge, or television? Ted Turner - CEO of cable news network- made the following comment about interactive television: *'Every single interactive TV experiment has failed. Most people want to sit back and watch- interacting is hard work'.* (Ted Turner, 1994, p3). So do we want to interact with our televisions? It would seem, so far, that we do not, in a recent report by Towler (2001) for the Independent Television Commission, it was reported that 80% of the people with digital televisions said that they never or only rarely used any of the interactive services and that they had in fact bought the TVs because of the improvements in sound and picture quality. The consequences of this could be significant when the convergence of information and entertainment is taken into account.

At the moment mergers are taking place of several technology sectors: computers, telephone, broadcast, and cable television. To facilitate this merger and to make the new devices and services financially viable, manufacturers 'need' people to use these new interactive devices and services in their homes. This requires users to interact with devices in new ways e.g. carry out their banking via their television, or ordering food on-line via their microwave. It could be strongly argued that the very fact that these devices are in peoples homes is not enough in of itself to guarantee that people will use them in the way that manufacturers want and crucially 'need' them to use them.

In conclusion, the results of the survey show that currently devices are being designed with very little thought being given as to how, where and in what ways users will interact with the devices being proffered.

2.9 Marketing and Market Research

Market research plays an important role in the development, conception and marketing of new devices, therefore it was felt that it was important to take into account strategies employed by market research to gauge user acceptance and adoption of technologies by people in their homes.

Market research utilises the following methods to gauge whether or not people will use a new technology:

1) Ring people up and describe the product over the phone. This technique is the least expensive but the weakest. It tends to inflate positive responses since a verbal description can emphasise the positive attributes.

2) Intercept people in a shopping centre and show them still photographs, drawings or a simulation of the device. The problems are the same as the first approach.

3) A somewhat better technique is to show people in a laboratory or field setting the product. From this people can provide a more informed response. However, it is subject to the novelty effect.

4) Field trials are a way of overcoming the novelty effect. There is an added benefit of generating actual experience. The drawbacks are that trial can be expensive especially if the technology fails (as is common with new technologies) and they require a great deal of preparation and commitment of personnel.

5) Focus Groups**:** Have also been used by manufacturers to gauge ideas about product ideas and designs. Focus groups participants are usually pre-selected and pre-

screened individuals. A variety of stimuli are used such as mood boards, images, video, and theme sheets. Focus groups can provide important feedback to designers and manufacturers about the usability and acceptability of a product. (Adapted from Carey and Elton, 1996, p47)

Field trials were conducted by a market research group of the videotext system. The trials took place in Britain and Germany, the suggestions made by users were not fed into any subsequent redesign of the product (Schneider, Charon, Miles, Thomans, and Vedel (1991)). It is difficult to see, in this case, the point of involving users in trials if their suggestions were not going to influence any subsequent redesign. In focus groups users are encouraged to voice their opinions and ideas in a similar way to Future Workshops. It could in fact be argued that some focus groups have had a similar remit, focus and structure to that of Future Workshops (Brusberg and Mcdonagh-Philp, 2001). However, focus groups tend to be conducted out of context (something which Participatory Design and CSCW has cautioned against) and to have a more limited focus i.e. usually there is a focus on what the company, which is paying for the market research wants e.g. new ideas for kitchen appliances (Brusberg and Mcdonagh-Philp, 2001). For more information on focus groups see: Greenbaum (1998); Krueger (1998); Morgan (1998).

Market research has also employed 'scenarios of use' as a way to evaluate potential user satisfaction or dissatisfaction with products (Miles et al. 1992). They have been used to identify usability problems before launch of a product. The designer watches potential users work through some scenarios of use and subsequently redesigns the product. However, Miles et al. (1992) found that in practice, scenarios of use in marketing research, were being used merely as ways to decide between different product configurations and were not fed into product redesigns.

The above research shows that market research can provide feedback into the process of design, however, it also shows that this feedback can be curtailed and fashioned by the company the market research is being undertaken for.

2.10 Conclusion

This chapter commenced with a reflection on what the word 'home' has meant through the ages. Then went on to review ways in which people had personalised

their houses and turned them into homes. Ways in which designers had designed the home space over the last 150 years and how this has affected our homes and how we conduct our daily lives was evaluated. Designers were found to make assumptions about who they were designing for i.e. that families who were going to move into tower blocks would not have kitchen appliances and that people would welcome the opening up of spaces in the home. How these decisions had affected householders and what they had done to shape their homes according to their views. This was followed by the section on important spaces in the home and how that space is organised, decorated, made private or public. In this section control of space was found to be a critical issue in householders feelings towards their homes and the spaces within them e.g. whether they owned or rented.

A way to understand the way technology is assimilated into the home was highlighted. Gender and its importance in relation to use and acquisition of technologies was briefly touched upon. These studies highlighted that designers have in the past misunderstood what people want in a technology and how control over a technology mediates its use. Significant household artefacts and their affect upon and assimilation into the home was discussed.

Here again designers' misunderstanding of artefacts use in the home was discovered, especially in the case of the telephone and home computer. The social shaping of artefacts section touched upon studies from the past which had shown how artefacts had been socially shaped by homes and the people who use them. Further this section drew attention to the fact that our stage in our lifecycle has an affect on the artefacts we own and how we use them. This section highlighted that the evolution of an artefact is not solely in the hand of the designer but is in fact socially shaped by the environment it inhabits and the usage it is put to.

The future devices section presented what manufacturers were proposing for the future. Conclusions were drawn as to the appropriateness of these devices for the home. This particular section showed that manufacturers and designers may still not be paying enough attention to real users needs and wants and instead are, in the main, utilising a 'field of dreams approach'.

One aim of the review was to extract from past studies those methods most likely to be useful for the home studies. Some of the methods employed did indeed produce some very interesting ways to discover information about the home and our relationship with the technologies in it. However, there are grounds for disquiet in that these methods even though they purported to involve 'families', had no direct quotations, no indirect quotations, or findings from diaries etc, coming directly from the children of those families. It was unclear whether any attempt was made to interview the children. The only researcher to mention children in their study was Morley (1986) and that was only to say that during his studies he found that the children grew quickly bored with the interviews. Therefore the research methods used by the researchers in these studies may not be suitable or may need to be adapted for studies involving all family members.

3 Design Methods and Methodologies

'This divorce of art from technology is completely unnatural. It's just that it's gone on so long you have to be an archaeologist to find out where the two separated.' (Pirsig, 1974, p148)

3.1 Introduction

This chapter reviews the methods, tools, and techniques employed by Human-computer interaction (HCI) to design systems and devices. The chapter also reviews past efforts by the HCI community and others to involve users in the design process. The possible limitations of current methods employed by HCI for designing technologies for the home will be discussed.

What do we mean when we use the word 'design'? Winograd (1996) claims although design is labelled as a 'thing', it is easier, and more constructive to talk about design as a process or activity. The literature review therefore included a survey of how designers designed (collectively and individually) and where design ideas originate.

3.2 History of Human-Computer Interaction (HCI)

The main boost to the development of HCI can be traced to the Second World War. As various countries strove to produce better weapons, it was realised that an attempt should be made to study how to fit the skills and limitations of the operator with the machine. These studies developed into a new field called Human Factors Engineering in North America, and Ergonomics in Europe. People working in this field tended to have backgrounds in either behavioural science or industrial engineering. Physiologists and medical practitioners also contributed to the understanding of human capabilities and limitations in the work setting. Out of these experimental disciplines arose a body of knowledge that could be useful in the design of complex human-machine systems (Bannon, 1991). This body of work influenced researchers who were starting to study the interaction between people and computers. These researchers found that the users of computers were having difficulty in using them effectively and efficiently for their work as a consequence HCI as a discipline emerged.

As a consequence of this rather interdisciplinary research a number of seemingly unrelated disciplines contributed to the development of what we now know as HCI and they are: psychology, cognitive science, graphic design, sociology, computer science and engineering.

The focus in early HCI studies was on the use of laboratory studies. The problem with this use of small controlled experiments in laboratories was how to extrapolate and use their findings in the real world (Bannon, 1991). Another problem was the overuse of university undergraduate students as the participants in these experiments. The led to the focus in later HCI studies shifting to how to involve the user in the design process and make the design process more user-centered. One of the problems with this is what does the term user-centered system design (UCSD) mean, or how can it be achieved? The central concern of USCD is to produce systems that are easy to learn and easy to use by their users, and that are safe and effective in facilitating the activities users want to undertake. Participatory Design (PD) however, sees users as the central consideration in the design and development process. They both position themselves in contrast to system-centred design which has little if any focus on users. Both of these approaches to design are discussed in sections 3.2.1 and 3.2.2.

3.2.1 User Centered Systems Design

The three principles of UCSD, according to Gould and Lewis (1985) are:

1) Early focus on Users and Tasks: First designers must understand who the users will be. This understanding is arrived at in part by directly studying their cognitive, behavioural, anthropometrical, and attitudinal characteristics, and in part by studying the nature of the work expected to be accomplished.

2) Empirical Measurement: early in the development process, intended users should actually use simulations and prototypes to carry out real work, and their performance and reactions should be observed, recorded, and analysed.

3) Iterative Design: When problems are found in user testing, as they will be, they must be fixed. This means design must be iterative: There must be a cycle of design, test and measure, and redesign, repeated as often as is necessary.

Norman and Draper's (1986) approach to user-centred design was used to guide a team tasked with developing guidelines for human centred design processes for interactive systems. This team produced a set of guidelines which can be seen in ISO 13407 (1999). This document lists the four main principles of Human-Centred Design as being:

- The active involvement of users and a clear understanding of user and task requirements.
- An appropriate allocation of function between users and technology.
- The iteration of design solutions
- Multi-disciplinary design. (p2)

and specifies five main activities:

- Planning of the human-centred design process
- specification of the user and organisational requirements
- understanding and specification of the context of use
- production of design solutions
- Evaluation of designs against requirements (p4)

By using this approach the users' perspectives should help form the design and development process, which should have a positive influence on the usability of the end system/product.

User centered design however has evolved since the mid 1980s and is now said to: '*include almost any approach that emphasises methods, techniques and representations for software systems which place the user at the core of the development process* (Preece et al., 1994, p363).'

User-centered design is an important influence on HCI research, however, it does not emphasise user-involvement at the same level as that of participatory design, as Bannon commented: '*Although actual participation by users on the design team is mentioned, it does not figure prominently in the user-centered approach* (Bannon, 1991, p38).' This thesis positions itself more towards the participatory design approach, as a consequence there is an emphasis on the methods, tools and techniques employed by PD and a lesser emphasis on user-centered design methods.

3.2.2 Participatory Design

Participatory design (PD) as we know it had its very first origins in a programming language developed in the 70s called SIMULA. SIMULA was a object-orientated language, however, it was not developed as a programming language but as a mechanism to communicate complex systems to users in terms that were understandable (Nygaard, 1990).

Ehn was inspired by this approach and in 1970-80s led an effort to further develop concepts that were inspired by Nygaard and others at the Centre for Working Life (Arbetslivscentrum) in Sweden. The centres project teams work is illustrated by the DEMOS (Democratic Planning and Control in Working Life On Computers, Industrial Democracy and Trade Unions) project (Ehn, 1989) and the DEMOS project in 1975. These project were starting at about the same time that co-determination laws were being enacted in Sweden. They called their method: work-orientated action research. In the DEMOS project they applied their methods in four different areas: a repair shop, a newspaper, a metal factory, and a department store. Investigation groups were formed with local unions, where the academic researchers acted as resources, but the starting point of the investigations was always from the workers' perspective. The origins of PD are, therefore, in the democratisation of the workplace which was brought about by employee influence through unions and collaboration with management in some Scandinavian countries. However these early PD projects ran into a series of problems, the reasons for this, according to Greenbaum and Kyng (1991), were that while workers had a legal say in the workplace technology, the laws did little to shift the balance of power from a managerial perspective.

In the early 1980s, a 'second generation' of design projects were initiated in Scandinavia. These projects focused on the skills of the worker and how these could be used as leverage to push computer system design more towards a user's perspective. They took as their theoretical starting point Braverman's (1974) assertion that the act of dividing labour and deskilling workers is dehumanising[1].

The second generation of Scandinavian design projects took the issue of dehumanisation and put it at the forefront of the design and use of computer systems. Thus, the issue of quality of work and worker skill were put at the foreground of the system design projects. An example of this was the UTOPIA project. The UTOPIA project (a Swedish acronym for Training, Technology and Products from the Quality of Work Perspective) (Mayer, 1986) helped the

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[1] The book 'Labor and Monopoly Capital the degradation of work in the twentieth century' by Harry Braverman (1974), documents how capitalism increasingly takes skills away from workers and brings it more and more within the hands of the management. Braverman's main point was that the act of dividing labour and deskilling workers was dehumanising.

Swedish Graphics Union to develop a newspaper layout system that worked with the skills of the graphic artists (other systems that existed tended to de-skill workers, resulting in layouts that were homogenous). The researchers ran into several difficulties in trying to apply the tools and techniques of traditional systems development. In particular they found that those essential, yet not easily articulated qualities that we use in daily work were difficult for computer system designers to grasp using formal system specifications. The project made use of mock-ups, such as boxes with text labels on saying 'printer' to symbolise a printer.

In the early nineties there was a call for even further user involvement in the development of the design of systems. Greenbaum and Kyng (1991) called for PD and co-operative design to strive towards involving users fully in the design process. This to them meant full participation in the design process and not just nominal or symbolic representation in meetings or on committees. Also user involvement should mean creating new ways for designers and users to work together and not just fitting users into an already existing system development process. For them, user participation had to be something more than interviewing a sample of users and getting them to rubber stamp a set of system specifications. Despite this call from PD to involve users throughout the design process Carroll, Chin, Rosson, and Neale (2000) commented, as recently as two years ago, that it is still standard development practice to include user input only after initial concepts, visions, and prototypes exist.

Key Principles of Participatory/Co-operative Design

Participatory Design as proposed by Bjerknes, Ehn, and Kyng (1987) was developed to involve users more closely in systems design. Bødker and Gronbaek (1991) also looked at how co-operative and participatory design could be used to enable system developers and users to work together to design applications that better support working practices.

One of the main tenets of Participatory Design is that designers should respect users and treat them as competent practitioners in their field. By doing this and involving them in the design process the designer should be able to build to match the skill, knowledge and problems of the work and workers, rather than spending time building 'idiot proof' systems (Greenbaum and Kyng 1991).

Participatory design is thus not a single theory or technique, but rather an approach that is characterised by concern with a more humane, creative, and effective relationship between those involved in technology's design and its use (Suchman, Schuler and Namioka, 1993). The main tenets of participatory/collaborative design are:

- **Users are experts**: Participatory design acknowledges the importance of using the expertise of users and treating them as equal partners on a development team.
- **Tools should be designed for the context in which they will be used**: in traditional development environments, software applications are created in laboratories that are often not co-located with the user environment. Participatory design realises that an important step to designing new tools is to know where they will be used and in what context.
- **There should be methods for observing or interviewing end-users:** To gain an understanding of the environment in which the new application will be placed.
- **Recreating or play-acting a work situation will facilitate the design phase**: A participatory design session often has hands-on learning experience using mock-ups, play acting, and role-playing that focuses on the workplace, not the system.
- **Iterative development is essential.** The ideal participatory design project has several iterations of a design-feedback loop, where the developers ask the users for their opinions.

(Adapted from Namioka and Rao, 1996, pp.284-285).

PD aids users to move away from standard roles such as observer, approver, knowledge repository, and into a more active empowered role as a collaborative member of a design team (Allen, Ballman, Begg, Miller-Jacobs, Muller, Neilsen and Spool, 1993).

Several techniques have been adopted and/or developed to expedite participatory design the most prominent being scenarios, early prototyping/mock-ups, participatory design workshops in various guises, contextual design and contextual inquiry, ethnographic field methods, probes, and informal interviews. These are all discussed in more depth in subsequent sections. A new variant of HCI is being espoused, that of interaction design. Interaction widens the scope from traditional notions such as easy to use, utility etc to a wider set of concerns.

3.2.3 Interaction Design

Interaction design tries to involve all the different stakeholders in the design process. Johnson commented that: *'We have kept different stakeholders of interface design somewhat separated from each other'* (Johnson, 1997, p7) i.e. the engineer, the programmers, the users, and the designers are separated. Johnson thinks this is a situation that cannot continue and indeed with designers of systems using more collaborative practices we are seeing a move, albeit a slow one, towards designers working with users as a team to create systems and devices. One of the benefits of interaction design is that we are seeing a broadening of the traditional concerns of HCI to include such concepts as fun, aesthetics, entertaining and so on which have been highlighted by many HCI practitioners, Monk being one of the most prominent. One of the main reasons for this new set of concerns is the dramatic change that has been brought about in the graphical user interface. twenty years ago computer interfaces were command line interfaces utilised by MS-DOS. Since then interfaces have changed dramatically with the advent of the Graphical User Interface (GUI), interfaces. The focus in the past was on the hardware and making the system functionally efficient. As Crampton Smith (2002) comments, this was all very well in the past but we should be looking towards the future, she makes the following comments regarding how she thinks user interface design should develop: '*We've got a load of technologies but they're still... not very enjoyable to use. Good design is partly about working really well, but it's also about what something looks like, what it reminds us of, what it refers to in our broader cultural environment. It's this side that interactive systems haven't really addressed yet.'* (Crampton-Smith, 2000, p197)

Interaction design's aim is to meet the new set of challenges that the advent of interactive technologies has brought. It is this wider context, and also the criteria for assessing usability and user enjoyment derived from using a device, that is postulated by interaction design, as can be seen in Figure 3.1

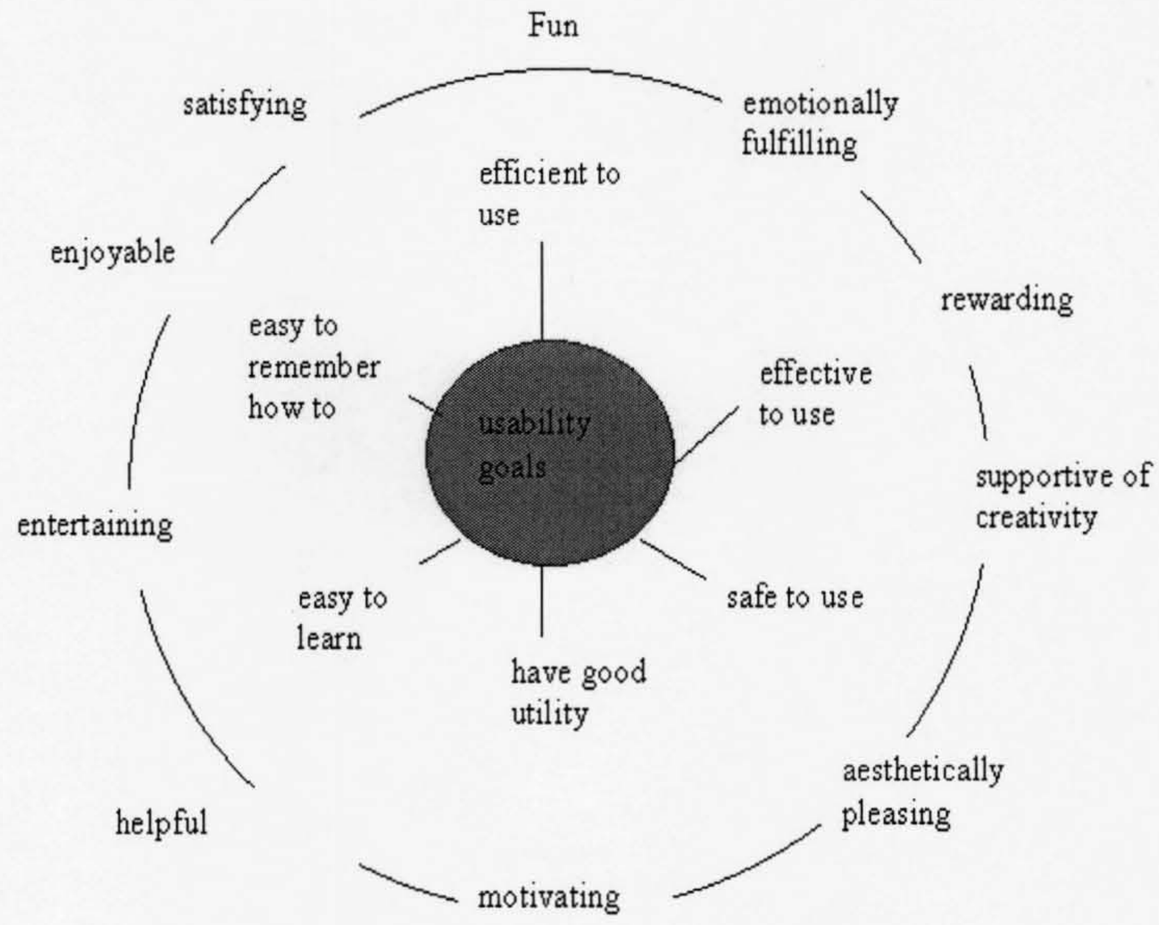

Figure 3.1: Usability and user experience goals. (Usability goals are central to interaction design and are operationalised through specific criteria. User experience goals are shown in the outer circle and are less clearly defined. (Preece, et al. 2002, p.19))

There are four processes and three key characteristics of interaction design:

1. Identifying needs and establishing requirements

2. Developing alternative designs that meet those requirements.

3. Building interactive versions of the designs so that they can be communicated and assessed.

4. Evaluating what is being built throughout the process.

(These activities are intended to be repeated and inform each other.)

The three key characteristics of the interaction design process. The processes are:

1. Users should be involved through the development of the project

2. Specific usability and user experience goals should be identified, clearly documented, and agreed upon at the beginning of the project.

3. Iteration through the four activities is inevitable.

(Preece et al., 2002, p12-13)

Norman (1998) commented that a good interface design has four elements:

- It should be visible (the user should be able to see its current state).
- Easy for the user to form a conceptual model of the tool;
- there should be good mapping between the interface and its functions
- there should be feedback to the user on the result of their actions. (Norman, 1998, p.188)

Interaction design is starting to meet this challenge as one of Durrell Bishop's (interaction designer) devices show. He designed a CD player into which CDs are inserted vertically, but which has only three buttons (back, forward and eject). Utilising a 'soft' flat panel display to add richer functionality when required. Interaction design however does not always advocate the inclusion of users as design partners or even involve them in the process. It can also have quite a limited focus i.e. on the marketability of the product rather than the usability.

In conclusion the main concern of HCI is with how people use computer systems to undertake and perform tasks, and with ensuring that computer systems are designed to be easy to learn and easy to use, in relation to the tasks for which they have been designed (Hackos and Redish, 1998). However the traditional areas of concern are being widened as their is a growing recognition from HCI practitioners that for some people their only use of a computer will be through the use of personal or domestic goods within which the computer itself is 'invisible', for example, digital watches, washing machines, microwave ovens, and video recorders, amongst other things (Norman, 1999; Stone, 2001).

3.3 Design Lifecycle

It is important, before continuing with this review, to consider the stage in the design lifecycle that this research is aimed at. The research is aimed at the very early requirements gathering and concept envisioning stage. Figure 3.3 shows a high level depiction of HCI design activities and where user requirements fits into this cycle.

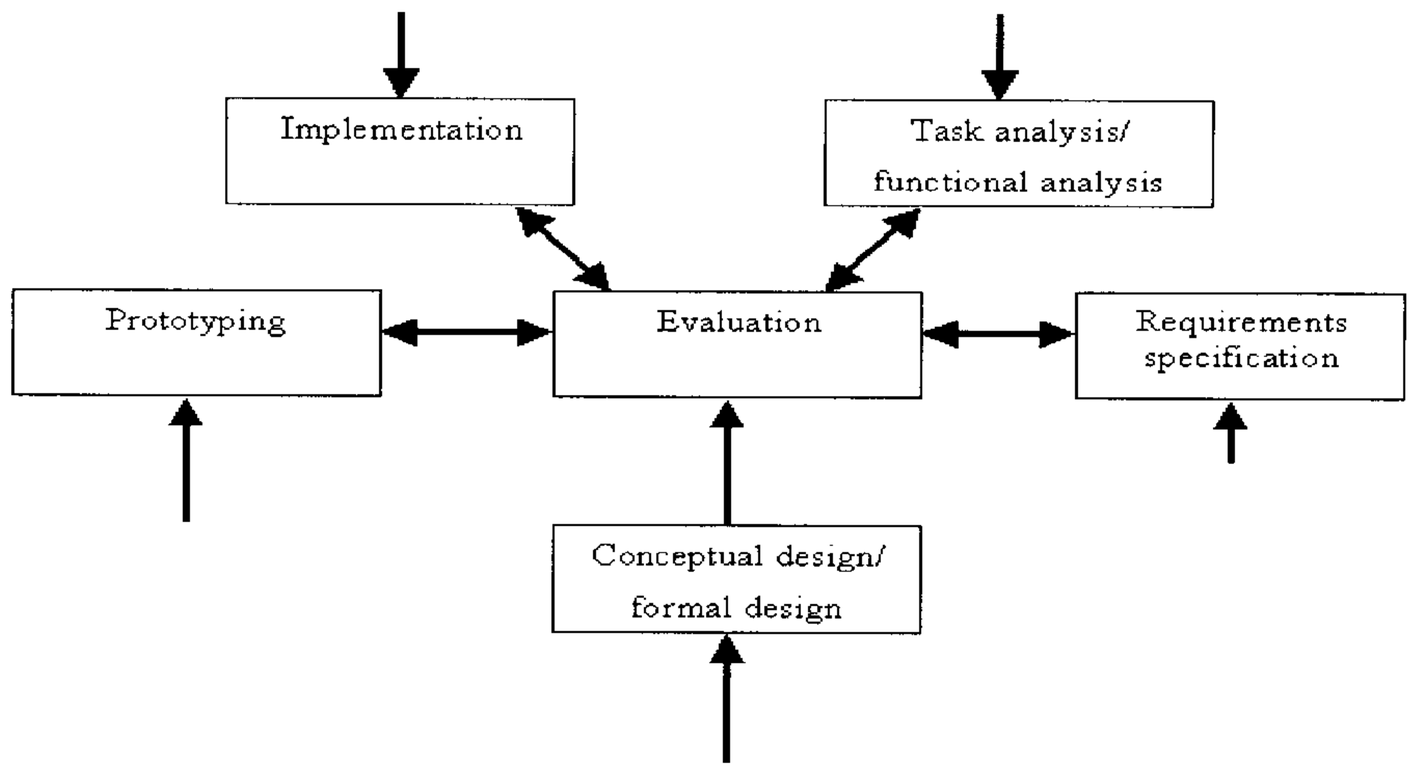

Figure 3.2: Star life cycle (Hartson and Hix, 1989)

The STAR model (Hartson and Hix, 1989) was derived as a result of analysing actual design practice among HCI designers by its developers. In the star life cycle (see Figure 2.9) development may begin at any stage (entry arrows) and may be followed by any other stage (double headed arrow). In this approach the requirements, design and product gradually evolve and become increasingly well defined.

To be able to design a system a designer must understand the intended purpose of the system. One of the ways of building this knowledge of the present and proposed system is to undertake requirements gathering. In HCI this involves, in the main, talking, observing and interviewing users. However it involves doing more than just asking the users what they want - it requires a detailed analysis of the users, their tasks, the domain for the system, and the environments within which the users will work. Other issues which must be considered and that are of importance to creating a successful system are the usability and technical requirements.

It has been pointed out by Bowers and Pycock (1994) that this stage of the design lifecycle is crucial as the outcomes of this phase will have a major impact on the final system produced, on later decisions affecting the device and further that decisions made here can be difficult to change at a later stage of the lifecycle.

Gathering the requirements for a system involves the undertaking of a number of activities, which all focus on gaining an understanding of the artefact that you are designing, who you are designing it for, and the environment in which it will be used. Methods utilised by HCI for requirements gathering and indeed for the whole of the design lifecycle (because as can be seen from above this stage cannot be separated from the lifecycle as requirements gathering is an iterative process) are outlined in subsequent sections.

3.4 User Centred and Participatory Design Methodologies

The methodologies reviewed here are the socio-technical models which centre on identifying the requirements for a system from a holistic point of view, i.e. they are concerned with the people (the socio-part), hardware and software (the technical part), and the particular organisations policies and procedures (Kotonya and Sommerville, 1998). They recognised that technological systems are

developed as part of, rather than in isolation from the broader organisational environment (Dix et al, 1998). Socio-technical methods include OSTA (Eason, 1988), ETHICS (Mumford, 1993) and SSM (Checkland, 1981). Other methodologies reviewed here are, Contextual Design (Beyer and Holtzblatt, 1998), and Design Collaboratorium (Buur and Bodker, 2000). All the methods reviewed here are rather comprehensive methods, therefore only a brief overview of each will be given.

3.4.1 OSTA (Open System Task Analysis)

OSTA is a method where the technical (or functional) requirements are specified alongside the social system requirements, that is, the usability and acceptability of the system. OSTA aims to describe the transformation that occurs when a technological system is introduced into the work environment. One of the main features of OSTA is that it is participative, users are consulted and involved at various stages in the design. A limitation of the method is that while it tells designers to involve users, it doesn't tell them how to involve users.

3.4.2 ETHICS (Effective Technical and Human Implementation of Computer-based Systems)

Like OSTA, ETHICS is concerned with specifying the social and technical requirements for a work system. It differs from OSTA, however, in that two different design teams work separately and concurrently to specify two sets of requirements. They then attempt to merge the two sets of solutions into one solution which most effectively meets both the social and technical requirements which have been identified, and which ensures a high level of job satisfaction for users.

3.4.3 Soft Systems Methodology (SSM)

It is concerned with identifying organisational requirements, of which people and technology are elements. SSM is more about understanding a problem, and the organisational situation of the problem, than in finding a solution to a particular problem.

SSM has seven stages which proceed from expressing the problem, to building models, to making recommendations for actions which will effect beneficial changes to the system. Within the methodology a distinction is made between 'real

world' stages (stages 1-2, and 5-7) and 'abstract' system stages (stages 3-4). Figure 3.3. summarises the seven stages of SSM.

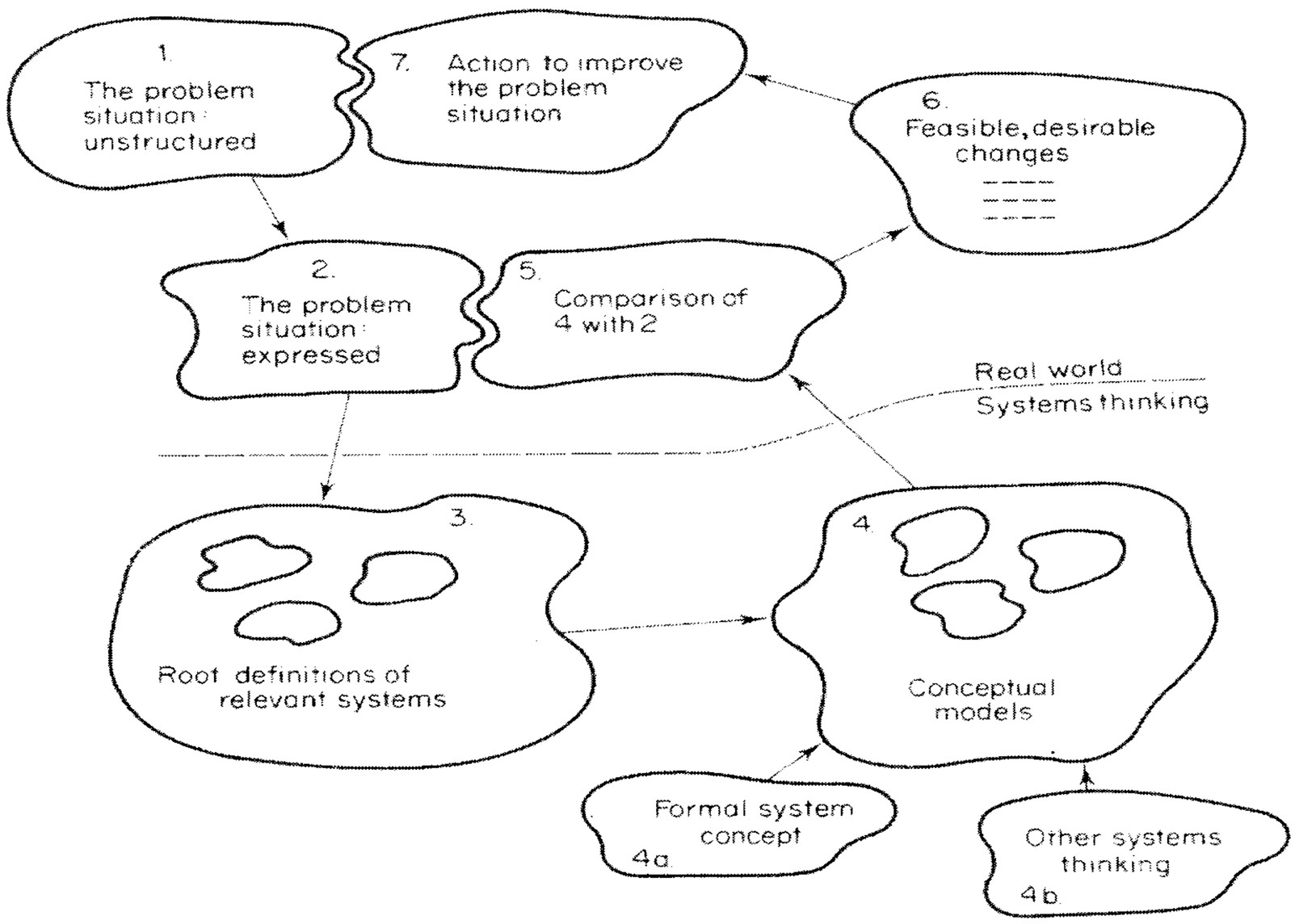

Figure 3.3: Soft Systems Methodology in Summary (Checkland, 1981, p163)

Generally information is gathered via meetings, interviews with stakeholders in context, questionnaires, and through observation of workers in the work environment. SSM is a flexible approach, but the method requires practice to use it effectively.

The method does not provide a single right or wrong answer but instead the application of SSM is considered to be successful if it assists the designer in building their understanding of the wider organisational system.

3.4.4 Contextual Inquiry and Contextual Design

The basics of the process were developed at Digital Equipment Corporation (Holtzblatt and Jones 1993; Whiteside, Bennett, and Holtzblatt 1988; Wixon, Holtzblatt, and Knox, 1990). Contextual inquiry provides four main principles that should guide a researcher who wants to collect field data:

- context - go to where the work is done to gather on-going (rather than summary) experience, and concrete (rather than abstract) data;
- partnership - create partnerships with the customer to break down customer interviewer barriers, in order to gain access to the knowledge the customers have about their work;

- interpretation - it is not sufficient to just observe customers; meaning must be assigned to what customers say and do; and
- focus - a designer will begin an inquiry with a set of assumptions (referred to as the entering focus), which will direct the information collection and analysis. Focus provides a framework for making sense of the work; focus can help reveal detail of the work it covers, while concealing aspects of the work it does not cover.

They then used the data collected to inform the next stage of the process: Contextual Design. Contextual design according to Beyer and Holtzblatt (1997) starts by recognising that any system embodies a way of working. Once the data has been collected and analysed. The design team set about understanding the data using affinity diagrams, work models and consolidation to see common patterns and practices. Prototypes are built and extended upon by the design team.

Collecting contextual data is important, however gathering this data in the home may be more difficult than in the workplace, for example, a workplace tends to have set hours, people are there to work and carry out tasks, whereas in the home, people are not always carrying out tasks or even undertaking activities.

This approach is interesting, however it seems to be too focused and built around the workplace to allow easy adaption for the home. Also the method focuses on collecting data and requirements from the user and does not involve the users in the actual design or concept building of the system itself. However their method for modelling and analysing data were found to be of interest as they build models of the users workspace and the breakdowns that occurred between the spaces and the artefacts contained and used within it.

3.4.5 Design Collaboratorium

In their design collaboratorium, Buur and BØdker (2000) illustrated how three industrial usability groups, in cooperation with HCI researchers, worked to reframe their own practice. The usability groups moved from their normal work setting towards a new way of working more collaboratively, which they called the 'Design Collaboratorium'. The term reflected their wish for a more open space in which designers, engineers, users and usability professionals met and worked alongside one another. Their work illustrated how using a more collaborative framework for design could lead to early, creative engagement of usability issues and design.

In Buur and BØdker's opinion there was a need to reframe usability practices as they felt that usability testing in a laboratory, and in fact usability testing, was too limiting for usability work; one of the reasons they gave for this was: *'The impact of use contexts and actual use situations is extremely difficult to reproduce in a lab, in particular in single user testing sessions'* (Buur and BØdker, 2000, p.298). Buur and BØdker (2000) involved participants and ensured that their voices were heard in the design process in many ways. One of the more interesting was one in which the participants were videoed and asked to voice their concerns and opinions about a new PC-TV being proposed by Bang and Olufsen. The video was then shown to the stakeholders (designers, engineers, marketing personnel) so that they were aware of the users' opinions. The researchers also created some posters with the participant's comments on them which they put up on the wall in the stakeholders shared design space. They hoped that by doing this any subsequent design would be influenced by the opinions and comments of the users, they report that this is indeed what happened. Buur and BØdker also found that a very important aspect of the design collaboratorium was to allow users hands-on experience with mock-ups and prototypes. They found that hands-on experience is a prerequisite for real user participation. Also prototypes are not simply objects to be tested; they become props in a collaborative attempt to discover essentials of possible future use situations.

Buur and BØdker demonstrate, with their work, that users' voices can be heard in a design process without users actually having to be present at design meetings. Some of the techniques utilised by the Design Collaboratorium have been found to be useful in other projects (Bauersfeld and Halgren, 1996; Suchman and Trigg, 1991). From their comments (see above quotation) it could be suggested that to investigate context of use in anything other than the actual context, would be extremely difficult. Secondly, the concept of 'context', it could be argued, is even more important in the home, as people have had more of an input into their home environments in terms of decoration, devices, and physical and social organisation of space.

3.5 User Centred and Participatory Design Methods

The methods used by HCI and other design practitioners cover a wide spectrum. The main focus in this review was on methods which had attempted to involve

users in the design process at some stage. The methods are reviewed and conclusions are drawn as to their appropriateness for use in a home study.

3.5.1 Workshops

Design workshops have been utilised by many researchers in many different projects, see Namioka and Rao (1996); Kensing and Madsen (1991); Andersen, Kensing, Lundin, Mathiassen, Munk-Madsen, Rasbech, & Sorgaard, (1990), amongst others. The majority of these researchers have noted that the origins of their design workshops are in Jungk and Mullert's (1987) 'Future Workshop' technique. Various researchers have changed and adapted the Future Workshop to suit their particular focus and needs. The Future Workshop technique which was used and adapted for this research took as its source and guide the original technique as invented by Jungk and Mullert.

Jungk and Mullert's Future Workshop is not a design workshop in that its background is not in participatory or collaborative design. Robert Jungk was a victim of Hitler's regime and became a refugee in 1933. He said that one of the experiences he felt at that time was a feeling of powerlessness. Ever since, he has tried to look for ways that people can fight back and influence the course of events. The Future Workshop, he remarks, is such a way.

The first Future Workshop was conducted in 1962. The Future Workshop technique involves ordinary citizens, and can encompass a wide age range, further the technique is not tied to any particular place. Moreover, Jungk and Mullert prescribe a philosophy of eschewing more scientific methods in favour of giving participants free rein to talk about 'irrational feelings, yearnings, dreams, and visions'. Jungk and Mullert's ideas sit well with the research's desire to explore the quality of contribution that families can make without imposing either the researcher's ideas or unnecessary constraints. Table 3.1 summarises the main elements of a Future Workshop.

Preparatory Stage	*This is when all the practical arrangements are made.*
Session One	*Critique – during this phase all the grievances and negative experiences relating to the chosen topic are brought out into the open.*
Session Two	*In this phase the participants come up with ideas in response to the problems, and with their desires, fantasies and alternative views. A selection is made of the most interesting notions and small working groups develop these into solutions and outline projects (often still of a rather Utopian nature).*
Session Three	*Implementation - coming back down into the present with its power structures and constraints. It is at this stage that participants critically assess the chances of getting their projects implemented, identifying the obstacles and imaginatively seeking ways round them so as to draw up a plan of action.* *The groups work out what would be necessary in order to produce a real solution to some of the fantasy themes generated (e.g. by producing a mock-up or a story board).*

Table 3.1: Summary of The Activities Associated With a Future Workshop (adapted from Jungk and Mullert, 1987, p.11-12)

Jungk and Mullert believe that their technique taps into the biggest and most neglected resource of them all: people's imaginations. Their technique has been used all over Europe. Some of the places and people that utilised the technique were: Elsinor (Denmark) where it helped to rejuvenate an otherwise boring conference; in Vienna where children came up with ideas for updating the school system and increasing environmental protection; in Paris where it helped people living in the 15th arrondissement threatened by large scale business development, produce alternative plans of their own, and many others. Future Workshops have been used for:

- problem-solving: schools, pressure groups, etc.
- designing: for neighbourhoods.
- enlivening: seminars, meetings and conferences.

Future Workshops were adapted for use in design projects, the format remains the same with some minor adaptations, but the name has been changed to 'design workshops'. Design workshops have helped users and designers to generate alternative ideas about how they would like their work situations to be in the future (Kensing and Madsen, 1991). Anderson also used design workshops to help users and designers to generate alternative ideas for the future collaboratively (Andersen et al., 1990). Anderson et al., (1990) suggested that the toolbox of most designers would benefit from being supplemented with this approach.

Design workshops are not only useful for encouraging users and designers to envision the future but have also been found to enable participants to see and analyse different historical forms of work juxtaposed (Karasti, 1997). She said that this gave the participants space and powers for comparison and evaluation. Further it assisted them in reflecting on changes and in making more informed estimations of future use situations.

Design workshops and Future workshops represents a technique that is more user-driven than traditional methods. The orientation is toward helping users take part in the design process. This is made possible mainly by communicating in everyday language and by focusing on actual users and their needs, rather than on the average user. The main findings of the workshops mentioned here was that holding design or future workshops enable people to articulate current problems, generate visions for the future, discuss how these visions can be realised and to enable participants to make comparisons between current and future proposed practices. There are some practical problems applying this approach to design; for instance, time pressure during the workshops, and ensuring that the researcher inspires discussion without manipulating. However, these problems are not limited to this approach.

3.5.2 Prototyping/Mocking-up

Prototypes have been used by designers to help the user to envision: the functions and features of a future system, interact with a proposed system, and to help raise any problems which may be associated with future use. Prototypes can be as basic as a box with a label on it to represent a printer (Ehn and Kyng, 1991) or a complex mock-up of a system. But why use prototypes or mock-ups instead of a finished system?

Bannon (1991) has argued that there is a need for prototypes as it would be impossible to map out in advance all possible users' needs and requirements successfully through the techniques of observation and interviewing. He has argued that users need to have the experience of being in the future use situation, or an approximation of it, in order to be able to comment on the advantages and disadvantages of the proposed system. Thus some form a mock-up or prototype is required in order to let users know what the future use situation might be.

Some of the advantages of exploring use using prototypes or mock-ups with users are:

- they encourage 'hands-on experience', hence user involvement beyond the detached reflection that traditional systems descriptions allow;
- they are understandable, hence there is no confusion between the simulation and the 'real thing,' and everybody has the competence to modify them;
- they are cheap, hence many experiments can be conducted without big investments in equipment, commitment, time, and other resources; and last but not least, they are fun to work with. (Ehn, and Kyng, 1991, p172).

In conclusion prototypes are useful not because they mirror real things, but because of the interaction and discussions they generate.

Design games

Another way of mocking-up is the use of design games. These can be used to facilitate design by playing. Design games can involve all users and help spawn group discussions. Ehn and Sjorgen (1991) found that design games helped them to understand the overall work organisation, skill requirements and division of labour. They invented a design game during one of their projects because they found that the system descriptions did not make sense to the workers, therefore, no co-designing was taking place. The design game consisted of: a map of the factory walls, cards representing the various workbenches and machines currently used. The workers were asked to place the cards on the map and illustrate the current positioning of benches and machines. The researchers then discussed with workers the problems they experienced with the current layout. They then used the cards to design and discuss new alternatives. The main uses of the game were: to create a common language, to discuss the existing reality, to investigate future visions, and to make requirement specifications on aspects of work organisation and education (Ehn and Sjogren, 1991).

Another way of using cards for mocking-up and facilitating design was proposed by Muller (1991); he called his technique PICTIVE. The technique was design to be used by people who were not necessarily programming professionals, so that everyone could be involved in the design process. The technique uses two sets of 'design objects' the first set of objects are everyday office stationery, such as, pens, paper, high-lighters, Post-it notes, and paper clips, etc; the second set of objects are plastic squares in assorted colours with domain- specific icon designs

drawn on them, a suite of paper, images of pop-up events, and several sheets of blotting paper. Muller (1992) thought that the technique worked because it had a democratising effect as everyone was working with the same tools i.e. the stationery or plastic squares. There was also an open sharing of views. The sessions were video taped and an analysis of the tapes was undertaken by the system developer, this it was hoped, would lead to an improved design of the system for the user.

The disadvantages of this technique are: poor transfer of the system concept from the design sessions to the developer of the prototype; a lengthy period of time was needed to transcribe video-tapes; the developer was not always present - this led to the people who were present to approve any suggestions put forward.

This technique, while interesting, was focused on very fixed concepts of what constituted an interface. This approach would be difficult to apply as it would be difficult for a researcher to take along a set of design objects. However, the idea of working with stationery to produce a mock-up of a system is something that is of interest.

Storyboarding

Storyboarding is another prototyping technique. A storyboard shows a scenario of something being used (Houde and Hill, 1997). Storyboards are considered to be effective design tools by many designers because they help focus design discussion on the role of an artifact very early on. However, giving them status as prototypes is not common because the medium is paper and thus seems very far from the medium of an interactive computer system. However, storyboards can be used to represent a design idea and can serve the purpose of asking and answering design questions.

In conclusion the main advantages of using prototypes are: they are fun to work with, they give hands on experience, there is no confusion between them and the 'real thing', and finally, they are cheap!

3.5.3 Scenarios: Creation, Design, Evaluation

Scenarios are narratives describing what people do when engaged in particular activities (Carroll, 1997). Scenario-based design facilitates user participation in the development of design, as scenarios can be as flexible, informal, sketchy, or as

structured as you wish. The use of scenarios can be used at various stages of the design process e.g. in the first stage of the design process user stories could be used, from this concept scenarios can be moved onto to generate ideas of user requirements, and finally concrete scenarios could be used to evaluate a prototype.

Using scenarios in system development helps keep the future use of the envisioned system in view as the system is designed and implemented. Muller (1991) emphasised how 'low-tech' scenario exercises with physical objects like cards can help stakeholders 'problematise', that is transform their assumptions into open questions, and thereby better articulate their concerns and ideas (for a fuller description of PICTIVE see previous section).

Scenarios can also be used for 'a good' and a 'bad' use situations, this can help to clarify what users want, as well as what they don't want.

Future workshops could utilise scenarios to assisting in looking at the present work situation according to Bødker and Greenbaum (1991). They imagined that a scenario may be the outcome of a future workshop, or may be developed in an iteration with a future workshop, e.g. an early draft may set the stage for the workshop. A more finished version may be produced after the workshop.

Scenarios have been used in the workplace to facilitate discussions about new design concepts. However, can they be used in the home in the same way? Gaver and Dunne (1999) thought that the use of impressionistic scenarios may help communicate ideas about possible design concepts. However, they felt that conveying these ideas at this level to people in their home presented a challenge; for example, if the scenarios were presented too abstractly, people could not imagine living with the systems; if they were presented too concretely, the users would focus on the details rather than the overall intentions.

Kyng (1995) commented that it was difficult to see how scenarios that had been developed in a workplace setting could aid design of a new technology in the home. He commented that there were broadly two different kinds of scenarios: work situation descriptions' and 'future use descriptions'. Both types of scenario are traditionally heavily driven by user experiences. It is clear how work descriptions can be driven by user experience, for example by interviewing

workers and field studies. However it is less obvious how future use scenario could be used to design a home technology.

One way of using scenarios in the home might be to collect user stories. Using users stories to create scenarios of use is another way of capturing data. Orr (1996) commented that: *'technician's stories of their work are part of diagnosis, and help preserve the knowledge acquired for the benefit of the community. Stories are more than a celebration of practice, they are an essential part of the practice to be celebrated.'* (Orr, 1996, p142). Hughes, O'Brien and Rodden (1998) in their home studies found that when people think of a new technology they think of the possible uses they could have for it and translates these into scenarios, for example, in one user study a participant was asked whether s/he would like to own a video phone, an excerpt of their response is given below:

> *'S: I mean the phone isn't something we particularly enjoy and want to develop, its ermm. more of an intrusion, I think it would be awful! If somebody comes out of the bathroom and walks past the phone out there. Or if you've still got your curlers in!.'*(Hughes et al., 1998, p257)

In addition, O'Brien et al. (1999) found, in their studies of the home, that people do not just think of stories when talking about current technology but actually apply these stories to possible new situations with new devices. Their research shows how users' stories of their practices in the home could be a rich source of information about how and when people use devices.

Tollmar, Junestrand, and Torgny (2000) collected scenarios from the home as a way of approaching the design of new devices for interpersonal communication. Their key argument was that if we base our designs on daily practice, this may inhibit truly innovative ideas from taking form, and, on the contrary, if we design using pure intuition and visions, the design is likely to fail due to a lack of connection to daily practice. They suggested that a possible solution to this problem is to use scenario-based design in conjunction with field observations such as ethnographic studies, which they thought would help them to retain ties with everyday life.

It is clear from the above pieces of research that people in the home think in terms of scenarios and that they talk about future possible uses of a technology in scenarios (O'Brien et al., 1999). Tollmar et al. (2000) found that using scenarios helped them develop concepts for design and aided them in the evaluation of that

design. When thinking about the possible application for the home workshop it is interesting to note that, as Carroll (1997) says, scenarios can be as informal and sketchy as you like. From these studies it can clearly be seen how scenarios can be used to inform the design process and involve users in design. These studies also suggest that the use of scenarios in the home as a way of eliciting information from householders about current activities and also perhaps orientating them to the possibilities for new devices designs may prove to be a fruitful one.

3.5.4 Probes

Some researchers have thought about ways to collect data in the home while the researcher was not present (Gaver, Dunne, and Pacenti, 1999; Eggen, Hollemanns, and Van De Sluis, 2002). The work of Gaver et al. (1999) contained some novel ideas about how to gather data from the home. The researchers wanted to design new technologies for three community groups of elderly people, in three different countries, in different community settings. The researchers gave each member of the groups a pack that contained: maps, postcards, cameras, and booklets. The researchers said that these were designed to provoke inspirational responses. They felt that postcards were an attractive medium for asking questions because of their connotations as an informal, friendly mode of communication. Each probe included a disposable camera.

On the back of the camera they listed their requests such as your home, what will you wear today, etc. They asked the participants to put together a photo album: with 6-10 pictures in which they were asked to tell their story. Finally each probe contained a media diary in which the participants were asked to record their television and radio use, including what they watched and with whom. The researchers hoped that the probes would act as part of their strategy of pursuing experimental design.

> '*We approach research into new technologies from the tradition of artist-designers rather than the more typical science- and engineering–based approaches. Scientific theories may be one source of inspiration for us, but so are more informal analyses, chance observations, the popular press, and other "unscientific" sources.'* (Gaver et al., 1999, p24)

The researchers thought that if they had used official looking questionnaires or formal meetings they might have cast themselves in the role of doctors, diagnosing user problems and prescribing technological cures. On average less than half the probes were returned to the design group. It could therefore be

suggested that a more proactive approach than simply turning up and leaving a pack and asking for it to be returned is needed when involving people in home design projects. In conclusion, probes offer a way of accessing information about people's lives when the researcher is not present and perhaps offers the participants a more relaxed method of providing the researcher with information.

3.5.5 Diaries

Diaries have been a useful method employed by researchers to discover more about homes and working practices. However, when trying to study the use of a new television and video combination device in the home, Kjaer, Madsen and Petersen (2000) found that some of the methods commonly used by HCI research did not work well in the very situated context of the home. In particular, the research team had problems with getting families to fill in incident diaries they had given them. The diaries had worked well in a trial setting in a laboratory, however, the research team found that in the real-life setting of the home the diaries were not filled in by the families. Kjaer et al. postulated that there could be several reasons for this, such as: no one to remind the family to fill it in, other things to do such as, reading, sleeping, relaxing, etc. However they did have some success with short interviews and scenarios.

3.5.6 Touring Homes

Mateas, Salvador, Scholtz and Sorenson, (1996) carried out an interesting pilot ethnographic study in ten families' homes. The researchers undertook a tour of each of the family's homes during which they noted the location of any technology and the layout of the rooms. They then split the families into two groups; one group contained the parents, the other group the children. The researchers had brought a flannel board with felt pieces representing rooms, people, artefacts and activities. They asked each family member to lay-out his or her house on the board, and then physically manipulate the pieces as they undertook a walkthrough of their day. They found that families in the home spend most of their time in clusters in family rooms and kitchens.

This study was of interest because it put forward the idea of looking around families' homes. The study had also included whole families, even though they were separated. When analysing this in conjunction with Venkatesh's (1996) ideas of social and technological space it was thought that an interesting area of

exploration in the home could be accessed and data gathered. One main drawback of the technique employed by Mateus et al. (1996) could be foreseen in that they did not ask the families about their own technology. As Campbell (1995) and others have highlighted, objects have certain meanings to their owners because of the part that they have played (or still play) in their life experiences. Such meanings as these, however, are usually invisible to others (or at least they are to strangers). To assume, therefore, that the casual observer can 'read' the technology that an individual possesses without asking them about them is to override or ignore this dimension. Therefore, it was felt that it would be more beneficial to talk to families about their use of a technology in situ. It was also felt that it seemed artificial to separate the children from the adults in the home, as this is not what happens normally.

3.5.7 Rich Pictures

Rich pictures is a lightweight method which involves users in the design process it was invented by Checkland (1981). A rich picture is a drawing which depicts stakeholders, their relationship to one another and their primary concerns. A rich picture is constructed by interviewing people, preferably in situ, as this helps them to demonstrate current practices using artefacts that are close to hand.

Monk and Howard (1998) found that rich pictures helped to organise, record, and discuss information supplied by users which may be of significance to the design process. The rich pictures helped to highlight contradictions in the different stakeholders comments and places were there were gaps in the data. They hoped that by encouraging developers to use rich pictures a more user-centered design process, as apposed to a system orientated, would be the result.

Rich pictures can be used iteratively throughout the design process as a rich picture can be drawn and re-drawn at any stage in the design process and shown to users to gain their feedback. In conclusion Monk and Howard say that rich pictures could be used as an abstract summary for storyboarding, and could assist PD by placing the design in its overall social context. Rich pictures can, therefore be used at any stage in the design process from requirements gathering to evaluation. They have been used successfully in user-centered design projects to aid understanding of stakeholders concerns and work practices. It is difficult to

see how this method could be used in the home workshops because there is no 'problem issue' or concept design or system to be discussed. However the concept of rich pictures could be used to aid the analysis as it could help the researcher to gain an overview of the households, and individual householders concerns in relation to current and possible future technologies.

3.5.8 Ethnographic Field Methods

Ethnography as employed by HCI and system design communities, most often refers an approach used to develop understandings of everyday work practices and technologies in use (Blomberg, 1995, p175).

There have been many ethnographically-informed studies conducted in the home. From those that examined a single piece of technology, to those that were interested in the social relations of families in the home, to those that were interested in building new technology for the home. Ethnographic field methods have also been widely used in the work space in order for the designers of a system to develop a deeper understanding of the work practices. For example Bentley et al., (1992) study of air traffic control. Harper's (1992) study of the social Organisation of two research laboratories and the systems they wanted to implement. Hughes et al., (1994) study the effectiveness of a new system that had been implemented in a Bank.

This section reviews the different methods employed to carry out an ethnographic field study that could be used in an investigation in the home.

The chief ethnographic methods are interview, observations and participant-observation. Ethnographic field methods have been used in design in many different guises some of these are listed below:

- Concurrent ethnography: where design is influenced by an on-going ethnographic study taking place at the same time as systems development.
- Quick and dirty ethnography: where brief ethnographic studies are undertaken to provide a general but informed sense of the setting for designers.
- Evaluative ethnography: where an ethnographic study is undertaken to verify or validate a set of already formulated design decisions.
- Re-examination of previous studies: where previous studies are re-examined to inform initial design thinking.

(Hughes, King, Rodden and Andersen, 1994, p.432)

Since the studies are to take place in the home, the 'Quick and Dirty' method was of particular interest to the research as a 'Quick & Dirty' ethnography can provide knowledge of the social organisation of the workplace in a comparatively short time (Sperschneider and Bagger, 2000). What a quick and dirty piece of fieldwork gives the researcher/designer is a broad understanding of the issues that have a bearing on the acceptability and usability of an envisaged system, rather than the specifics of the design. 'Quick and Dirty' ethnographic studies could, according to Hughes et al. (1994), be used to 'tweak' existing systems or to inform the design of the next generation of systems.

How can the data collected by ethnographic studies be used to inform design? Hughes et al. (1994), found that even though their ethnographic study discovered a rich set of data they had problems conveying these findings to the designers. Other researchers have found appropriate ways to conveying their findings designers. Harper, Evergeti, and Hamill (2002) found that a good was of conveying their findings was to compare their findings, on the use of paper mail, with its possible replacement, email. They found that this comparison highlighted the following issues which could inform designers:

- Screen(s): You may need more than one screen or more than one person may want to view a screen at any one time.
- Hand over is important: you cannot have a ceremonial handing over of an email.
- Strategic placement: in the case of the teenage son the parents placed the bill in a strategic position in front of the teenagers bedroom door.
- Monitoring of email may not be as subtle as the current monitoring of paper mail employed by families i.e. the parents will notice that the bill is no longer on the floor in front of the bedroom door.
- They also point out that the different location of the mail can indicated its position in the 'to-do list'.

Many people use email in the home. However, what Harper et al. were suggesting was that email will not, in their opinion, replace paper mail, because it does not have the affordances (mobility, easy to mark-up, flexible cross-referencing between two documents) of paper mail. Therefore an ethnographically-informed study helped interested parties to compare current practice with possible future practice and helped to articulate concrete issues and problems to designers of email.

Other researchers have also found that ethnography can act as an aid to understanding users even before the design has taken shape (Nardi,1997) and in the area of blue sky research as demonstrated by Rogers and Bellotti's (1997) finding that by using ethnographic techniques in a study of blue sky research, they helped designers to design ideas for future applications and new technologies. Their data also helped to act as a springboard[1], much in the same way as suggested by Burr and Bødker (2000) and Bødker and Christiansen (1997), to a discussion of more general design ideas. Another benefit of using ethnography in the home is its flexibility as a study can be re-shaped as the study actually takes place, this enables the researcher to take into account the fact that people are, as Nardi points out: *'Such surprising creatures that it is impossible to know what may be of interest in a research setting before the work is done'.* (Nardi, 1997, p362). This is not to say that the researcher should not have a framework to work to or a focus of interest, but it means that if an interesting new point or possible area of interest arises this does not have to be ignored as being out-with the realms of the study, but can be explored. This would not be possible if the study were being organised along the lines of a scientific experiment.

Ethnographic field methods, therefore, offer a way of involving users' views and opinions in the design process. They perhaps also offer a way of conveying findings to designers in a richer way than a standard report. Further it can be seen from these very different studies that a rich data set can be provided to designers about family practices in the home, and help inform future decisions about design.

As is pointed out in Chapter two it can seem quite remarkable how many products are designed and brought to the market with very little idea of how people will use them, whether they want or need them, or in fact whether they will use them at all. The use of ethnographic methods can help expose cultural themes which can lead to more effective marketing and design of products and can provide knowledge about the use of a device (Ireland and Johnson, 1995; and O'Brien and Rodden,

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[1] 'A springboard is a facilitative image, technique or socio-conversational constellation misplaced or transplanted from some previous content into a new (Engstrom, 1987, p287).'

1997). Also, ethnographic field methods can be a fertile source for design ideas (Nardi, 1997; Hughes et al., 1994).

3.6 Envisioning a Design

Crampton-Smith is of the opinion that there are two different phases of envisioning design: *'Firstly there's research - finding out about people. The second stage is thinking, what should this thing we are designing do?'* (Crampton-Smith, 2002, p198). Other researchers have commented that designing is a complex and highly creative process that blends intuition, experience, and careful consideration of numerous technical issues (Schneiderman, 1998). Designers of systems have endeavoured to produce 'efficient' work systems, however this has often resulted in the workers having mundane, repetitive and dull jobs to perform.

Some researchers in HCI have criticised the systems centered approach to design and have commented that some designers are still too firmly based in the PC's functional past (Johnson, 1997; Crampton-Smith, 2002). Johnson remarks that design has been too focused on the functional aspects and that designers should be encouraged to think of the design of an interface in a wider concept. He gives an example of how creative thinking can transform a technical achievement into an art form: *'From "A trip to the Moon"- Georges Melies 1902 special effects extravaganza - you could sense that something potent was in the works, but the idea that those jittery, flickering images would somehow evolve into Citizen Kane- would have seemed preposterous'.* (Johnson, 1997, p221) Therefore the idea he puts forward of the 'interface as art form' is an interesting one and, perhaps, beginning to be incorporated into HCI by designers.

Another way of designing devices and the one used predominantly for home devices is the 'field of dreams approach', i.e. if we build it they will come. As a result of this, according to Dholakia, et al. (1996), is that devices are being built for the home with all manner of software and services, with little being known about what users actually want. In a similar vein, Noyes and Baber (1999) criticise the design of 'white goods' saying that many of the functions are not used and that in fact many of the functions seem to be there at the behest of the marketing department. They think that in order to design something that people can use for work (or play), it is necessary to appreciate what the users' goals are,

how they achieve those goals at the moment, and what they require from a future system.

3.6.1 Collaboration and the envisionment of design

It is an unusual system or device that is conceived and designed by one designer. Sometimes there are creative people who will invent an idea totally by themselves, but as Preece et al., (2002) said: 'these people are few and far between.'

The invention of the Sony Walkman is a case in point, many stories have been reported on how the initial concept of the Sony Walkman came about. Some of the workers at Sony said that it was invented by Akio Morita, President of Sony, while walking in New York (Chamber, 1990).

Morita himself, however, recalled that the 'idea took shape' on the occasion when his colleague Masaru Ibuka came into his office with one of Sony's portable tape recorders and a pair of standard sized headphones (Morita, Reingold, Shimomure, 1987). The New York Times once informed readers that Kozo Ohsone was the man known within the company as the father of the Walkman (Sanger, 1990).

In contrast, Kozo Ohsone himself and former colleague Shu Keyama (Sony, 1989) both recalled that the Walkman emerged from a collective process. Therefore in this instance even though one person was largely credited with the invention of the Walkman it was in fact conceived and built as part of a collaborative effort between designers, engineers, researchers, and to some extent users (Sony conducted field studies to examine how young people acted around cities and invited users into their laboratories and asked them to use a prototype Walkman).

Inspiration or pinching?

Designers also receive or gain inspiration for their designs from many places. One example is given in Du Gay, Hall, Janes, Mackay and Negus (1997). Du Gay et al., asked one of the designers (Tsuchiya), tasked with designing a new model of the Sony Walkman, how he got the idea for the new design. He said that the idea was initially derived from a striking fashion photo.

He remarked that he was: *"Casting around" for a suitable finish and just happened to be "struck by the fashion photo".* (Du Gay et al., 1997, p73). It can be

seen by this comment that the designer was inspired by artefacts which were laying about his work space. Some researchers have suggested that designers should gather as many contributions from others as they can: *'to get a good idea, get lots of ideas.'* (Rettig, 1994, p26). Stone (2001) reported in her study of designers and how they design that, when asked, designers said that their design ideas came from other software packages and that they copied the good/relevant bits. One even remarked that he doesn't often do the design himself, he preferred to pinch from existing designs and adapt them for new designs. In fact designers are encouraged to be inspired by other designers, designs, and ideas. For example, Gould (1997) commented that when designers are designing a new system they should look for good starting points, learn about related systems, familiarise themselves with existing user interfaces, study existing systems, familiarise themselves with new influential systems and new technologies.

Another researcher, Schank commented that: *'A designer is someone who gets reminded of just the right prior experience to help him in processing his current experiences. And while those experiences may be the designer's own, they can equally well be others.'* (Schank, 1982, p22).

Therefore, designers are already informed by other peoples ideas and by other similar technologies. If designers are already using several sources as inspiration for devices, then why not use users' ideas and concepts as an additional source to inform the design process as well?

3.6.2 Householders as Envisioners of Design

'Designers often avoid coming to grips with the question of who the users will be. This is due in part to the strong and subsequent effect the answer will have on subsequent design decisions. Even where designers define early who the users will be, the implications of this decision do not always drive subsequent design decisions in as powerful way as they should, for example, we know of one advanced technology interface that was developed for a specific list of executive users. Yet the designers never talked with or visited the offices of these executives - even though they worked in the same building. The result was that the system was never used.' (Gould, 1997, p236)

Do designers want to involve users in design? Crampton-Smith comments that she does not think that users should be part of design teams, as she believes that it is an abdication of responsibility. Gaver et al.(1999) and Buur and Bodker (2000) could be said to agree with this as in their studies users were only involved in providing data about themselves to the designers and evaluating prototypes.

However is there any real need to stop users from advancing their own ideas about concepts for design? Surely as professionals, the design team would take on board their suggestions as just one more source of inspiration and information, as they do at the moment by looking at other similar devices on the market (as highlighted in a previous section). Why are designers and design teams so reluctant to embrace the possibility of including users' ideas as another form of inspiration, as being inspired by others ideas is something they do already? Perhaps a reason for the reluctance is that designers in the past have encountered problems when asking people to envision future possibilities. Crampton-Smith (2002) opines that the ability to visualise things is one way traditional design can help with design, however she feels that this visualising process is best left to designers. Greenbaum and Kyng (1991); and Gould and Lewis (1985) would agree to a certain extent with Crampton-Smith's assertions in that they found that what they called transcendence versus tradition was another problem with the concepts behind full user co-operation because users tend to be conservative or traditional in how they look at their workplace. Additionally designers involved in collaborative project teams would often complain that asking users to visualise new forms of work was an impossible task, for given the day-to-day reality of work, most of us see it as it is. However they thought that using envisionment tools may offer a way out of this dilemma.

McKim (1972) also thought that the ability to visualise a design was important, he postulated that everyone can visualise, it is just that society has encouraged us not to. McKim's suggestion indicates that it would be difficult, but not impossible, to encourage people to design in their homes, but that they may need additional stimuli to make this possible.

Can non-designers be involved successfully in a design project? The KidStory Project (Benford et al., 2000) involved children from Sweden and England working together with adult researchers to develop computer tools for collaborative storytelling. They used co-operative inquiry (Druin, 1999) The team found that if children were treated as collaborators, they could indeed engage fully and productively in all aspects of design. In addition Mueller (1986) found that using art-based methodologies to assess children's attitudes resulted in a more accurate measure of the actual attitude of the children than that of more traditional

evaluation methods. Drawings he argued reflect an internal image held by the child and not that of the adult administering the test. Therefore the workshops may benefit in an unexpected way from asking children to draw i.e. that of finding out what children really think about technologies compared to repeating what they perceive an appropriate response.

People have designed systems for their own homes. In a study of households by Silverstone and Hirsch (1992) they found that the father had set-up a system which worked the central heating and lighting. The system which had been in operation for three years and was zoned throughout the house, had different settings for different times of day and a series of heat sensors that regulated the operation of the computer programme, therefore, some individuals are already designing for their own homes.

Involving users in design projects may cause some real world problems. Bødker, Ehn, Sjorgen, and Sunblad (2000) found the following problems when carrying out the KidStory project: time constraints, gaining permission for the study from the school and limitations in physical surroundings. The home workshops could therefore by affect by constraints of a similar nature. For example, what if a family had no table that they could use for drawing? As regards the act of designing new technologies, with children it was expected that they would have at least taken part in recent art activities and would therefore be relatively comfortable if asked to sketch out an idea. But how would an elderly person respond? Time constraints would almost certainly be an issue: it was anticipated that a researcher would have to be flexible in scheduling and re-scheduling of home visits.

In conclusion people will not necessarily be good designers of home devices, but even unusual suggestions may be grounded in tacit knowledge related to aspects of the home that designers of a home device may not fully understand (BØdker and Gronbaek, 1991). It could be argued, therefore, that exactly the same reasons that were given for involving users in the design process in the workplace put forward by participatory/co-operative designers and other researchers could be said to apply equally well to the homeplace i.e. that by involving the user the designer gains an insight into the existing system and learns of possible problems

with a proposed new system, and that by involving users a designer gains an understanding of the users perspective (Greenbaum, 1993).

3.7 Conclusion

The aim of the literature review conducted in Chapter 2 and 3 was to extrapolate from previous studies a set of methods which may be appropriate for undertaking an investigation in the home. The methods reviewed that were of particular interest and were thought to be adaptable for a home workshop are discussed in this section.

Workshop

Workshops were of particular interest as they had in the past provided a way of involving users at an early stage in a collaborative design process. As Kensing and Madsen (1991) commented, workshops support the creation of visions about future work situations. They felt that the best way to facilitate the creation of those visions was to undertake a workshop. Jungk and Mullert's 'Future Workshops' technique (Jungk and Mullert, 1987) was developed to involve ordinary citizens, with a wide age range, and is not tied to any particular place. Although there are many benefits to Jungk and Mullert's concept of a Future Workshop (a summary of the activities associated with a future workshop can be seen in Table 3.1). The following difficulties could be foreseen if the framework was followed too closely in the home, for example, their idea that people should be free to voice any grievances or problems may cause offence if not handled correctly, especially in the home. Some of the households would only contain one person, therefore, the idea of discussion groups would not be feasible. Therefore instead of following their framework exactly, it was instead used as a guide when trying to develop the structure for the home workshops.

Touring Homes

Mateas et al. (1996) carried out an interesting study in families' homes. As part of that study they undertook an inventory of technology in each of the homes. It is unclear from their work if the researchers were accompanied by family members, what they hoped to gain from the tour, or what they in fact found out from it. Their study was nevertheless of interest because it suggested the idea of inspecting families' homes. Further a tour may provide clues to the organisation of the social and technological space and the interplay between activity and

physical space which were highlighted as being of importance by Venkatesh (1996) and O'Brien et al. (1999).

Future Devices

Prototypes can help people to envision the functions and features of a future system or device. Prototypes can be as basic as a box with a label on it or a nearly finished system (Ehn and Kyng, 1991). Buur and Bødker (2000) also found that a very important aspect of the design collaboratorium was to allow users hands-on experience with mock-ups and prototypes. This is because hands-on experience encourages real user participation. A clear benefit could be seen in creating paper visions of the future with families and then swapping these artefacts as another way of gaining feedback from families about their thoughts on technologies and gauging their reactions to proposals' especially the more extreme ideas that may be some of the families visions for the future because as Bannon (1991) argued users can comment on the advantages and disadvantages of a proposed system.

In order to facilitate the participants being able to envision future possibilities and to give them something tangible to manipulate, pictures of future devices should be added to the workshop session to aid the participants to critique current future visions from manufacturers, to enable a discussion to take place about what the participants did or did not want, and to provide more information about their relationships with technologies.

Using Scenarios for Home Orientated Research

Scenarios have proved to be useful tools in collaborative design in the past (Bødker and Greenbaum 1991; Carroll, 1997) and as O'Brien et al. (1999) pointed out scenarios are intuitive: when people think of a new technology they think of the possible uses they could have for it and translate these into scenarios. Additionally Tollmar et al. (2000) used observation studies to help create scenarios, which were in turn used to assist the design process. A clear benefit could be seen in using scenarios to discuss with participants their current use and possible future uses of technology.

Designing with Families

An essential part of the workshop concept was that the participants should envision their own ideas for future devices for the home. It was not clear at first whether this was an achievable aim as other researchers have encountered

problems with getting users to envision future concepts, a typical comment is that: *'for an innovative product users are unlikely to be able to envision what is possible'* (Preece et al., 2002, p165). However, other researchers have commented that: *'visual thinking is not the exclusive reserve of artists' (McKim, 1972, p8).* And another that visual thinking cannot be the exclusive reserve of artists as visual thinking is constantly used by everybody: *'It directs figures on a chess board and designs global politics... an inventive housewife transforms an uninviting living room into a room for living by the judicious placements of lamps and arrangement of furniture' (Arnheim, 1965, p1).* Therefore it was clear that participants would in all probability be able to create visualisations of home designs, however, they may need stimuli to enable them to do this. The first session of the workshop is orientated towards providing this stimuli.

Gathering Data

Some of the successful and perhaps more importantly unsuccessful ways of gathering data in the home that have been reviewed in this chapter. For example, O'Brien et al. (1999), Harper, Venetia, Hamill, Strain (2001) and Harper et al. (2002) used ethnographically informed studies. Another way of gathering data was to ask families to fill in diaries, questionnaires, take part in interviews and tour family homes (Kjaer et al., 2001; Morley, 1986; Mateus et al., 1996). Gaver et al. (1999) used cultural probes as a way of gathering data from elders in their homes. In their study it would seem that what the they did with the probes was to try and understand the elders view of the area. However, it is not clear what the probes achieved that other methods would not have. However, the concept of a fun way of gathering data when a researcher was not present was thought to be beneficial.

The idea of touring families homes and conducting home interviews were adopted for the home workshops. Additionally it was felt that it was important that there should be a way of gathering data when the researcher was not physically present, as highlighted by Gaver et al (1999), in the home as there may be interesting ideas or thoughts that the participants may have in-between workshop sessions. Realising that participants lead busy lives and might only have a very short time to scribble down the information that occurred to them, it was decided that Post-it™ notes may be a fun means of collecting 'between visits data'.

4 Home Studies

'Workshops can provide a way to openly discuss the irrational feelings, yearnings, dreams, and visions that all of us carry as embryos within us.' (Jungk and Mullert, 1987, p37)

4.1 Introduction

The first step in widening the scope of HCI enquiry to the home is to determine if techniques designed for the laboratory or workplace are appropriate. The background research discussed in Chapters Two and Three highlighted three strands of literature, that were particularly relevant: co-operative or participative design, ethnographic studies, and previous studies that had taken place in households. This chapter outlines the structure of the Home Workshop. Section 4.2 explains how the workshop sessions were set-up, and gives a brief introduction to the families involved in the study. Section 4.3 describes the purpose and conduct of each of the sessions. The final section, 4.4, provides an explanation of how the data were collected and transcribed and provides an introduction to chapters 5, 6 and 7.

4.2 Setting up the Workshops

Five households in central Scotland agreed to take part in a series of home-based workshop sessions. When planning a study of this sort for the workplace the researcher would arrange such meetings with management. A room may be put aside, which the researcher can arrange beforehand, and the people will generally be available at the time arranged. When arranging such meetings with families this becomes a more complicated situation as it involves negotiating times when all the family members are available. As a consequence there are only brief windows in a family's timetable in which one can meet them. Arrangements can also be changed, at the last moment, if one of the family falls ill.

4.2.1 Participants

The households that volunteered for the study ranged from a family with two young children to a single woman of eighty-four. Two ways of recruiting possible participants were used. An email was sent out to the whole of Napier University asking if anyone would be willing to take part in the study. The email briefly outlined the workshops, the number of visits, and the duration. Anyone who thought that they might be willing to take part was asked to contact the researcher via email. This resulted in one family being recruited. The other participants were recruited through friends of friends.

This was done in the following manner:

1) Colleagues and friends of the author were asked if they knew of any person or family that may be interested in taking part in a study of this nature (with the caveat that the researcher should not know the people they asked) .

2) If a colleague or friend did know of someone, they were asked to show them the one page outline of the workshops and ask them if they were willing to take part.

3) Once the potential participants indicated they were willing to take part, the researcher phoned them and outlined the workshops to them and asked if they were still interested in taking part.

This resulted in four households being recruited through friends of friends and one family through email. All bar one (the reasons for this are explained in more detail below) of the households continued without problems to the end of the workshops. Despite the household's self-selecting to take part the researcher was fortunate enough to attract, in this small sample, a good cross-section of society, with some of the participants living in affluent areas while others occupying modest public-sector accommodation. The age of the participants ranged from seven to eighty-four and educational attainment was varied with some still at school, some having left school at sixteen and some with a higher degree.

All the families gave permission for the data collected as a result of the workshops to be published. To preserve anonymity, pseudonyms have been used. A summary of the participants and their circumstances is given in Table 4.1 Each family and their homes are described in more detail in subsequent paragraphs.

Identifier	Who		Sex	Age	Occupation	House	Technologies
Cook	Robert	Father	M	50	Lecturer	Victorian, 4 bedrooms, dining room, drawing room, lounge kitchen, two bathrooms and a cellar.	A mixture of old and new, games consoles, computers and television.
	Sue	Mother	F	45	Housewife		
	Dianne	Daughter	F	10	School Pupil		
	Tarquin	Son	M	7	School Pupil		
Petric & Naysmith	Catherine	Partner	F	25	Recruitment Consultant	Semi-detached house newly acquired, two bedrooms, lounge, kitchen, bathroom.	Mainly new technologies, games console, mobile phones, etc
	Gordon	Partner	M	29	Admin. Officer		
Suttons	Emily	Wife	F	70	Retired teacher	Victorian house: two bedrooms, parlour, livingroom, kitchen and 2 bathrooms.	Standard technologies, TV, sound system, etc.
	Peter	Husband	M	72	Semi-retired builder (own business)		
Smiths	Mike	Father	M	46	Joiner	Public-sector apartment, two bedrooms, lounge, kitchen, bathroom	High tech, lots of new technologies, e.g. digital TV, PC, Mobile phones, etc.
	Barbara	Mother	F	44	Catering Assistant		
	Simon	Son	M	15	School Pupil		
Reilly	Agnes	Widow	F	84	Retired Cook	Public-sector house, two bedrooms, lounge, kitchen, bathroom	Low tech, portable TV, small sound system.

Table 4.1: Participants in the study

The Cooks

The Cooks live in Kinghorn, Fife, in a large Victorian house which has been adapted and added to over time. The home consists of on the ground floor: drawing room, kitchen, dinning-room, family room, stairway to cellar, and utility room. The first floor contains four bedrooms and a bathroom. The house also has a large walled back garden and a spacious cellar. The family consists of Father (Robert), mother (Sue), son (Tarquin) and daughter (Dianne). The mother is a housewife and the father a lecturer. On first arriving at the house I was welcomed at the door by the family and shown into the drawing room. This was quite a spacious room which was furnished in quite an old-fashioned style, with heavy furniture, wooden flooring with rugs, a piano, heavy velvet curtains and a sound system. I explained the workshop process to everyone. The first session was the longest and lasted two hours; the subsequent workshops lasted between an hour and an hour and thirty minutes. The first and second workshops were four weeks apart. The final workshop (because of the Christmas break and problems of scheduling visits- this was a common problem with only one researcher and five

families) was approximately two months later instead of the one month or less that would have been preferred.

Petric and Naysmith

Petric and Naysmith live in central Edinburgh. They are a young couple in their late twenties. They had acquired their home only two months before the commencement of the workshops. The home is semi-detached and on only one floor. The home consists of: hallway, livingroom, kitchen, bathroom, main bedroom, single bedroom. The home also has a large front garden. The home was built circa 1950. The house was in the process of being redecorated throughout the workshop sessions. The home contains many new pieces of furniture but also some older and some mismatched furniture and technology (both Petric and Naysmith had both owned their own flats before moving in together, and therefore brought quite a few pieces of technology and furniture with them to the new house). The sessions were slightly longer with this couple than with the other participants. This was mainly due to the fact that they owned more technologies than the other participants and seemed to be quite intrigued to be part of a research process.

The first session was the longest, at approximately two and half hours, the subsequent sessions were roughly one and a half to two hours in duration. The biggest gap between sessions was with this couple, because of Christmas, illness and busy working lives.

The Suttons

The Sutton's house is situated at the entrance to the historic town of Musselburgh. Musselburgh contains three golf courses and a race course, much to the delight of the Suttons, who are avid golfers. They are senior citizens who have a very busy social life. They have two grown up children and several grandchildren. Their home is Victorian and has a front and back garden. The back garden is walled with a gateway which leads straight to the beach. The outlook from their house is to Musselburgh harbour and the Fife coast. The ground floor consists of: parlour, bedroom, and kitchen (which leads to the back garden). The first floor originally contained two bedrooms but has now been made into one through lounge, with large windows looking out over the Firth of Forth. The reason for this change

from two bedrooms to one large room is that they do a lot of entertaining and need the space for parties. This floor also contains a bathroom.

The second floor contains a large bedroom which again had large floor to ceiling windows which looked out over the Firth of Forth. The first session conducted with the Suttons lasted the longest of all the sessions – approximately three hours. The second session was shorter than expected because Emily Sutton seemed quite tired. The third session did not take place at all as they could not continue with the sessions because Emily had a serious illness. She has since fully recovered and is back playing golf!

The Smiths

The Smiths live in a notorious public-sector-run estate in Stirling called Raploch. All the houses have been uniformly built and residents are not allowed to change any of the fixtures and fittings in their homes. The family consists of: Mother (Barbara), Father (Mike) and Son (Simon). The home consists of: hallway, living room, double bedroom, single bedroom, kitchen and bathroom. The family have access to a communal back garden. The home contained numerous technologies which seem to be the latest models. The first session lasted approximately two hours, the second was four weeks later and lasted an hour and a half. The final session took approximately one hour.

Reilly

Mrs Reilly is a senior citizen who lives alone. She lives in a small and quiet former mining village in Midlothian called Rosewell. The house is owned by a housing association. In common with the public sector house mentioned above, residents of the housing association homes are not allowed to change the fixtures or fittings in their homes. The house consists of: hall, living room, bedroom, kitchen and bathroom. In addition, the house has a small front garden and a large back garden. The first session was the shortest of all the first sessions. This may have been because of the difficulty of sparking a conversation between only two people, one of which was trying to work a camera and take notes. However, the subsequent two sessions went very well; one of the main reasons for this was the use of the Post-its™, which Mrs Reilly found very useful to gather her ideas and thoughts after the first session.

4.3 The Workshop Methods and Foci

A workshop in the home should, it was hoped, provide a way for the participants to discuss their existing home technologies and generate alternative ideas for future technologies for the home. One focus of the workshop concept was to enable participants to generate visions for the future, and to discuss how these visions can be realised. Another was to provide a juxtaposition between the technology tour and future devices, in that the historical context of the technology tour should remind the participants of current practices and the future devices should alert them to new proposals being made by manufacturers, so as to enable them to make informed comments. Table 4.2 shows the focus and the methods for each of the three workshops. A fuller explanation of each method is given in subsequent sections.

	Focus	Methods
Preparatory Session	Planning and collecting family data	Telephoning families, gathering equipment: stationary, video camera, tapes.
Workshop One	Investigate current problems and Future Possibilities	1.Technology Tour 2.Representations of emerging technologies 3. Scenarios
Inter-workshop activities	*Collecting data in-between sessions*	*Post-it notes*
Workshop Two	Contextualising ideas for the home in the future and daily life	1. Informal interview 2. Materializing ideas for future technologies
Workshop Three	1. Sharing ideas across families 2. Modifying and elaborating designs	1. Critique 2. Redesign

Table 4.2: The methods and focus for each of the workshops

4.3.1 Preparatory Stage

Each family was telephoned or emailed to arrange a time and date for the workshop. No restrictions were placed on the time or day of the workshop. The researcher took to the workshop sessions: a video-camera, note pad, audio-tape recorder, scenarios, pictures of future devices, and a tool box containing craft materials e.g. glue, paint, pencils, pens, colouring pens and pencils, Sellotape™, Post-its™ (in various colours), paper, clay and rulers.

4.3.2 Investigate Current Problems and Future Possibilities (workshop 1: Technology Tour, Scenarios and Future Devices)

Workshop 1 was seen as an opportunity for the researcher to learn about the households and the technology contained within them. In the first instance this was achieved by carrying out a 'Technology Tour'; the aim of which was to collect information about existing technologies. The second part of the workshop aimed to stimulate discussion about future devices, which was done by showing the families pictures of emerging technologies. The third part of the workshop focused on discovering what artefacts the participants used to undertake certain activities, through the use of scenarios. Therefore the first workshop was split into three separate but overlapping parts.

Technology Tour

The 'Technology Tour' is a new technique that was invented and used in two trial home sessions, one in Denmark and one in Scotland (these sessions are reported in: Peterson and Baillie, 2001; Baillie and Peterson, 2001). The Technology Tour involves asking whole families to take the researcher on a tour of their homes.

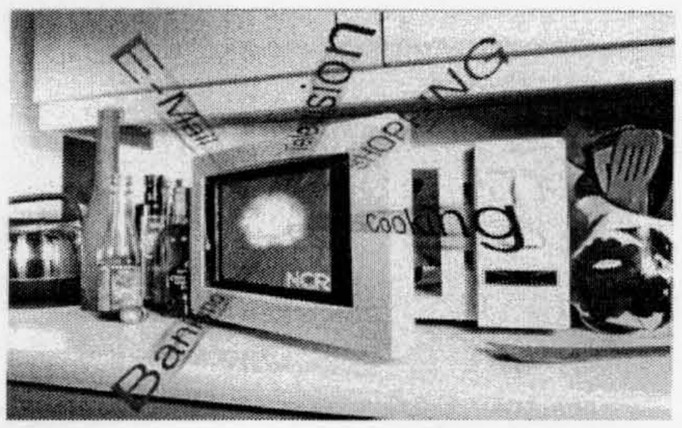
Several researchers have pointed out that the way in which technology is integrated into the physical and social organisation of the home provides useful clues to understanding the use of technologies (O'Brien & Rodden, 1997; Venkatesh, Shih, and Stolzoff, 2000; Venkatesh, 1996). Thus this focus was maintained in the technology tours during the first part of workshop 1 by asking the families to take the researcher on a tour of their homes. In these rounds the researcher asked about possible conflicts in ownership of space (O'Brien & Rodden, 1997; Venkatesh, 1996) as well as the history, flexibility and motivation for the physical organisation. The researcher further asked the participants to describe problematic situations they had experienced with the technology and they were asked to show how they used the technology (Sperschneider and Bagger, 2000). The main thrust of the technology tour revolves around four key issues:

- what technology is present in each room;
- where is it placed;
- who uses the technology;
- how it is used.

Representations of Future Devices

To try to orientate the participants towards thinking about new technologies for the home and to aid discussions about technologies for the home, the families were shown pictures of some emerging technologies. The devices included things such as the fridge that 'knows' when it is out of milk, the microwave with email and the i.link, which enables users to link-up various Sony products, and so on. Figure 4.1 shows one of the devices and the format in which it was shown to the participants (see Appendix 1 for a full list and description of these devices).

NCR: Interactive Microwave



Main Features

- Home shopping: The user can order their shopping from any of the major supermarkets offering an on-line ordering service. The device can also arrange for the shopping to be delivered.
- Home banking: The device offers all the main banking facilities for example the user can check their account balance, transfer money and pay bills.
- email and internet service
- Television: By touching a symbol on the screen the user can watch Television.
- Cook: The Microwave will retrieve recipe suggestions and dietary information from the World Wide Web.
- Bar code reader

Figure 4.1 Future Device: Interactive Microwave

The researcher described the functions of each device and then discussed with the families how they could potentially use the technology, how it might constrain or liberate them. If a participant liked a particular device he or she was asked to keep the representation in the household, and live with it, until the next workshop. This was done so that the participants could annotate the representation with additional comments that they had not thought of during the first workshop. The reason for showing the participants the future devices in the first workshop and not in the design workshop was that it was thought that they might have an excessive influence on the participants' designs.

Scenarios

When it comes to home technologies, the ability to conceptualise the social setting of the design and its use is crucial. Scenarios seem to be an ideal tool for facilitating understanding of possible new systems that may be far more complicated than the one-user-one-computer situations, on which traditional HCI

has focussed for many years. Scenarios can also be used to facilitate user participation in the development of a design, in addition, scenarios can be as flexible, informal, sketchy, or as structured as needed. Scenarios are thought to offer an effective way of stimulating discussion. Scenarios were written that involved the participants undertaking a task which would involve them using various current devices in the home and possible future devices. For example, if people were wanting to go out with friends they may want to know what was on at various places e.g. comedy clubs, cinema, etc. Two scenarios were thought to be appropriate and believable for this study (the scenarios used can be seen in Appendix 2). The researcher presented the participants with the scenarios and they were invited to choose one to work through.

Inter-workshop Activities

A way of gathering data in-between workshops sessions (as the studies were going to be carried out over several weeks) was thought to be important, otherwise important ideas and thoughts of the participants may be missed. Post-it notes seemed to be an ideal artefact to leave with the participants. It was felt that the free form of a Post-it, and the ease with which they can be written on and stuck to devices would make them easy to use. They would not leave any permanent marks on the devices and their bright colour would mean that they were less easily forgotten. The participants were encouraged to write any comments they wanted on the Post-its and stick them onto an existing device or one of the future devices. It was anticipated that the Post-its would provide an effective method of gathering people's reactions when they felt ready, and not when the researcher was ready.

4.3.3 Contextualise Ideas in Home and Daily Life (Workshop 2: Discussion and Design)

The second workshop was split into two parts. The first part was a discussion in which the researcher talked to the participants about the Post-its that had been collected and about any issues the researcher or participants wanted to discuss from the first workshop. In the second part of the workshop, the focus was on envisaging design. Participants were provided with craft materials (pen, paper, glue, etc.) and asked to create visions of concepts for devices.

They were requested to either design a solution to a current problem or to envision a new device that would be of benefit to them in their homes. There were three reasons why families were asked to envision their own technology for the home. First, home technology at the moment is mainly built and designed by manufacturers and designers using the 'field of dreams approach'. Secondly, it was hoped that by asking the participants to think of their own solutions to current problems and envisage some novel ideas for designs, the workshops would be providing another way of extracting and learning about the needs and wishes of the participants for the future. Thirdly, it was anticipated that by designing their own technology for the home it would help some of the more diffident participants to create an overflow in their imagination as described by McKim (Figure 4.2).

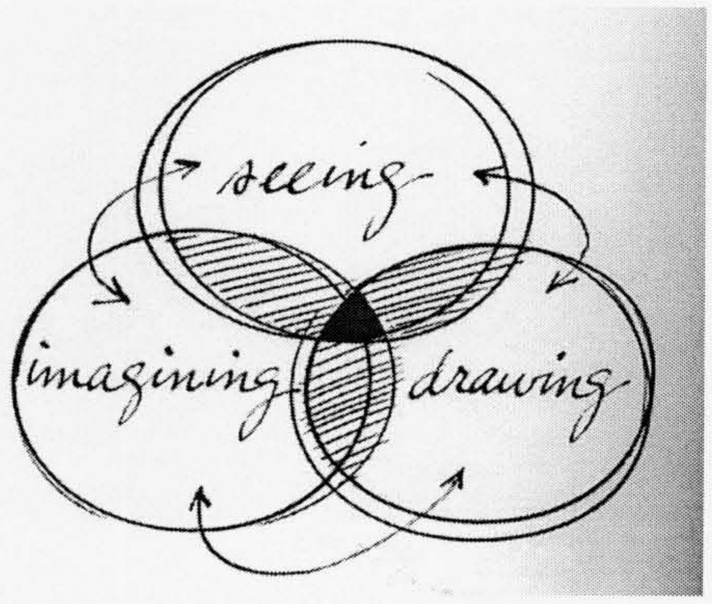


Figure 4.2: Interactive Imagery (McKim, 1972, p8).

'Where seeing and drawing overlap, seeing facilitates drawing, while drawing invigorates seeing. Where drawing and imagining overlap, drawing stimulates and expresses imagining, while imagining provides impetus and material for drawing. Where imagining and seeing overlap, imagination directs and filters seeing, while seeing, in turn, provides raw material for imagining' (McKim, 1972, p8–9).

The three overlapping circles symbolise the idea that visual thinking is experienced to the fullest when seeing, imaging, and drawing merge into active interplay. Benford et al. (2000) and Druin (1999) have found that children can take part fully in a collaborative design process. Therefore, it was felt that asking participants of all ages to envision a design in their homes was something that could be accomplished and one that would be of great benefit to the workshop process. The researcher set no limits on their design ideas. She further emphasised that they did not have to worry about what was possible at the present time. The

only stipulation was that the design had to be something the participant could use in his or her own home.

4.3.4 Discussion Critique and Iteration (Workshop 3: Critique and Redesign)

In this workshop the participants were asked to critique the designs of the other participants. They were then asked to use these criticisms as a way of improving upon the original design. In the critique part of the workshop the researcher introduced and explained the other participants' designs to the different family groups. Each paper prototype was passed around and the main concepts were explained. The participants were encouraged to comment on the designs. The purpose of the critique was to learn about what the other families thought of one another's designs, to encourage them to think more about their own design, and to let them see how other families had designed differently from them. The second part of this workshop consisted of asking the participants to re-design one of the other participant's designs by choosing their favourite design and redesigning it. The intention was to gather data about possible new functions and about the usability of the designs. Another area of interest was to see whether people could think of ways in which they could use this device in their homes.

4.4 How the Data were Collected

The workshops were videotaped. Some of the first workshops were also audio taped and some hand-written notes were also taken. However, as the research was mainly undertaken on a solo basis it proved impossible to continue to use all three. It was therefore decided to switch to using only the video camera, and while this solution has its drawbacks it proved to be the only feasible solution.

Note taking on its own was not thought appropriate. While note taking is easily transferable to the field, and pen and paper have several advantages (ease of use, minimal expense, and unobtrusiveness) the drawbacks are obvious: every word and nuance in a social situation cannot be recorded and considerable effort would have to be expend to record data legibly and in an organised manner.

There are drawbacks to using video as a way of collecting data: the overheads involved in setting up equipment and reviewing videotapes after the fact can be time consuming (Beyer and Holtzblatt, 1997). However, it was concluded that since the research was mainly being undertaken by a single researcher it was the

only possible solution as one would be unable to note every word of each family member when they were talking in tandem. Further, Fetterman (1989) and Atkinson and Heritage (1984) suggested that the use of recorded data, such as video, serves as a control on the limitations and fallibilities of intuition and recollection.

Audio recording had been attempted, however it was found that because of the free flowing nature of the workshops, people would move quickly out of range of the tape recorder and data would therefore be missed. The video camera microphone was able to pick up words from all around the room. The video tape was transcribed in full, noting every word, gesture, cough, smile, laugh, lengthening or accentuation of words. In an attempt to make sure that the data had been analysed thoroughly all of the workshops were transcribed using conversation analysis transcription conventions. The transcription conventions can be seen in Table 4.3.

[ ]	Indicate the point at which a current speaker's talk is overlapped by another's talk.
(.5)	Number in parenthesis indicated the elapsed time in silence in seconds.
(.)	A dot in parenthesis indicates a tiny gap, probably no more than a second.
_____	Underscoring indicates some form of stress, via pitch and/or amplitude.
::	Colons indicate prolongation of the immediately prior sound. The length of the row of colons indicates the length of prolongation.
WORD	Capitals, except at the beginnings of lines, indicate especially loud sounds relative to the surrounding talk.
( )	Empty parenthesis indicate the transcriber's inability to hear what was said.
(word)	Parenthesised words are possible hearings.
(( ))	Double parenthesis contain author's descriptions rather than transcription.
.,?	Indicates speaker's intonation.
:-)	Indicates speaker is smiling.
:-(	Indicates speaker is frowning.

Table 4.3: Conversational Analysis Transcription Conventions (Silverman, 1993, p137).

A full analysis of the data was undertaken. The way in which this was conducted and the methods employed are discussed in Chapter Seven.

4.5 Conclusion

The framework for the Home Workshop has been well thought out and the techniques employed are based on previous studies either in the workplace or in the home. However, some of the techniques are new, i.e. Technology Tour for investigating current technology and its use, and Post-it notes for collecting in-between workshop data. Also, some of the techniques have not been used in the same way before. For example while people have always sketched and drawn, the use of this technique in the home to envision design, critique and re-design have not been used in any other workshops. Some of the techniques used in the workshop have not been used in the home before but have been used in the past in the workplace and educational establishments (Druin, 1999; Ehn, 1989) and on heterogeneous groups such as printers (Ehn and Kyng, 1991); primary school children (Benford et al., 2000); office workers (Bauersfeld and Halgren, 1996). The Home Workshop obviously differs in that it takes place in the home, but significantly it also differs in its use of these methods on a heterogeneous group (the extent of the heterogeneity of the group of participants can be seen in Table 4.2).

It is expected that these methods will be successful in the home because they have been carefully selected or have evolved from the review of applicable research material reported in Chapters Two and Three. Each method has a specific purpose and can therefore be evaluated as to whether or not its purpose was achieved . For example, the Technology Tour is expected to provide information about devices the households have and how they use them. The Future Devices should orientate participants to the possibilities for the future for the home. Scenarios are expected to provide information on how tasks are currently undertaken and artefacts used. This chapter has outlined the households involved in the study and the Home Workshop method.

4.5.1 Introduction to Empirical Chapters

This section acts as an introduction to the empirical work contained in the next three chapters. Chapters 5 reports on the data collected from the first workshop. The data and the observations made from the video and in situ enabled the researcher to draw models of the spaces and technology contained in the households. Models were drawn of an individual family member's view of the

home. A consolidated model was of the home was also drawn that included all of the household members observations and comments. A brief summary of the issues found by each technique in workshop 1 is given at the end of the chapter. Chapter 6 reports on workshop sessions 2 and 3. In the second workshop the participants were asked to draw and present a design that they would like to have in their home. The drawings are presented and comments made by the participants while presenting their design are shown as annotations to the design. In workshop three the participants were asked to critique the other participants' device concepts and to pick another participants design to redesign. In the critique section (6.3.1) the designs are shown annotated with the participant's comments. The redesign section follows a similar format to that of the design and critique section in that the redesign is shown and the comments are shown as annotations. In the final section a brief summary of the points highlighted is provided.

Chapter 5 and 6 report on what the participants said and did during the workshops i.e. what their home contained, what they had to say about the technologies contained within it, the designs they drew, their critique of the other participants designs, and the redesigns. Chapter 7 presents the findings from the analysis of the data collected and what this can tell us as researchers and designers. The analysis aimed to report on issues across family members and across different households and to see if the issues being highlighted were the same or different e.g. was control only an issue in one household or across households? Was control only an issue that was raised as a problem with current technology or was it raised as an issue when families talked about future technologies? The data was transcribed in full using conversational analysis transcription conventions. The background research had highlighted the importance of usability and spaces in the home as a consequence the main goals of usability and the concept of different spaces in the home were used as sensitising concepts to guide the reading and annotating of words and comments in the transcripts. This resulted in more than a hundred code words being used in the first rounds of analysis. This number of code words was of course unwieldy and it was also difficult to abstract clear meanings and findings from them. The transcripts and code words were, therefore, analysed using a method from grounded theory called 'Constant Comparative' (see Chapter 7, section 7.2.2 for a full explanation.). The analysis resulted in eleven

themes that are reported in Chapter 7. The chapter then presents a critical reflection on the use of the Home Workshop method in practice. Finally the Home Workshop method is compared against other possible research methods that could have been used to investigate the home.

5 Discovering Technology in the Home

5.1 Introduction

This chapter presents the data gathered from the first session of the Home Workshop. The data are presented by method, then by family. The first session was conducted in the following order: technology tour, future devices and scenarios. All transcription excerpts have been transcribed from video tape (except where explicitly mentioned).

5.2 Workshop 1: Technology Tour

This section presents detailed information gained from the technology tour. The technology tour was seen as an opportunity to learn about the households and the technology contained within them. It was felt that by asking the families how they used their technology, it may be possible to gain an insight into the use or non-use of technology. Families were asked on the tour not just to explain how they used a technology, but also actually *show* how they used it. The information obtained by the technology tour was conceptualised into consolidated technology and physical models for each household. If the home was viewed differently by different family members additional models were created to show this view. The models show the physical layout of the home (not to scale), the technology contained in each room, and the insights gained from comments made about that technology by each participant. Rooms that contained no technology but were viewed are shown on the map as being empty. The rooms that the researcher had no access to do not appear. Four distinct 'spaces' were found in the homes:

- Leisure: where householders relaxed watched TV, played games.
- Entertainment: where householders entertained visitors to the homes
- Communication: where the telephone, telephone directories, personal address books, calendars, pen and paper (for jotting down telephone numbers, messages etc) were located.
- Work: when a space was considered or viewed by one or more participants as a place where work was carried out.

These spaces are clearly colour coded and labelled on the models. When problems occurred with the technology or the space in the models this is shown as a lightening bolt. Beyer and Holtzblatt (1998) used models in a similar way to understand a workers view of their work space.

5.2.1 The Suttons

The first session was undertaken on a Saturday morning. The session lasted approximately two hours. The technology tour commenced in the lounge. The lounge is a large room. There are windows at either end. One set of windows looks out on the front garden and main road. The rear windows look out on the garden, Firth of Forth and Musselburgh harbour.

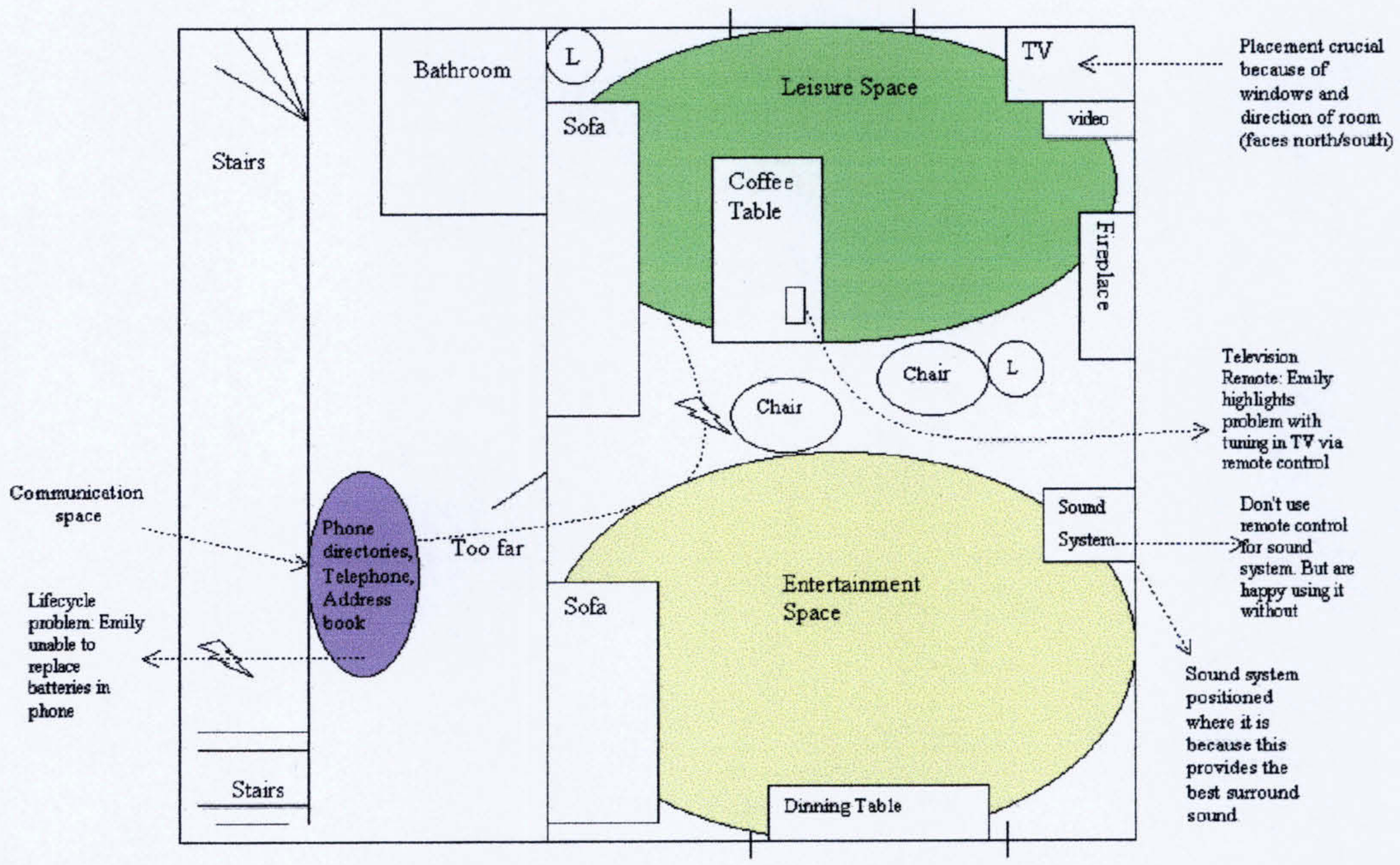


Figure 5.1: The Suttons 1st Floor. The model shows the first floor of the Suttons home. The mainly use this room for entertaining and it has clearly delineated spaces and technology that is contained within those spaces.

The Suttons gave a clear rationale as to why the technologies and other objects in their lounge were situated in the places they were. The sound system and television placement is an indicator of their lifestyle i.e. that the television is in the corner of the room in front of two comfortable chairs and a couch for relaxed TV viewing, and the sound system is in the middle of the room for when they are entertaining and utilising the whole room.

Hallway

Emily Sutton, upon seeing her phone in the hallway is reminded of an incident that occurred with the telephone. She describes an incident when she was trying to replace the batteries in her cordless phone:

> *Emily: It took me nearly a whole day, there were two bits of plastic sticking up that way ((she is miming what she was trying to do with the phone)). I tried to fit the batteries in, I could see the mark...where this thing was.*

> *I just thought to hang, I am fed up with this, I'll need to get someone to try and fix it and I just put the battery down on top of it like that ((mimes slamming the phone down onto the table)) and it slotted right in.*

This incident highlights that something that should have been easy to do and therefore learn, the changing of the batteries, was not easy to learn or carry out. This could have been due to the poor interface/illustration Emily was trying to follow on the phone.

Kitchen

The tour continues and we move downstairs from the lounge into the kitchen. A general discussion takes place about the use of various technologies in the kitchen. The kitchen is quite small and compact, which came as a surprise as the house is quite large. Emily commented that the kitchen used to be bigger but that they decided to make the kitchen smaller and use the extra space to make a guest bedroom.

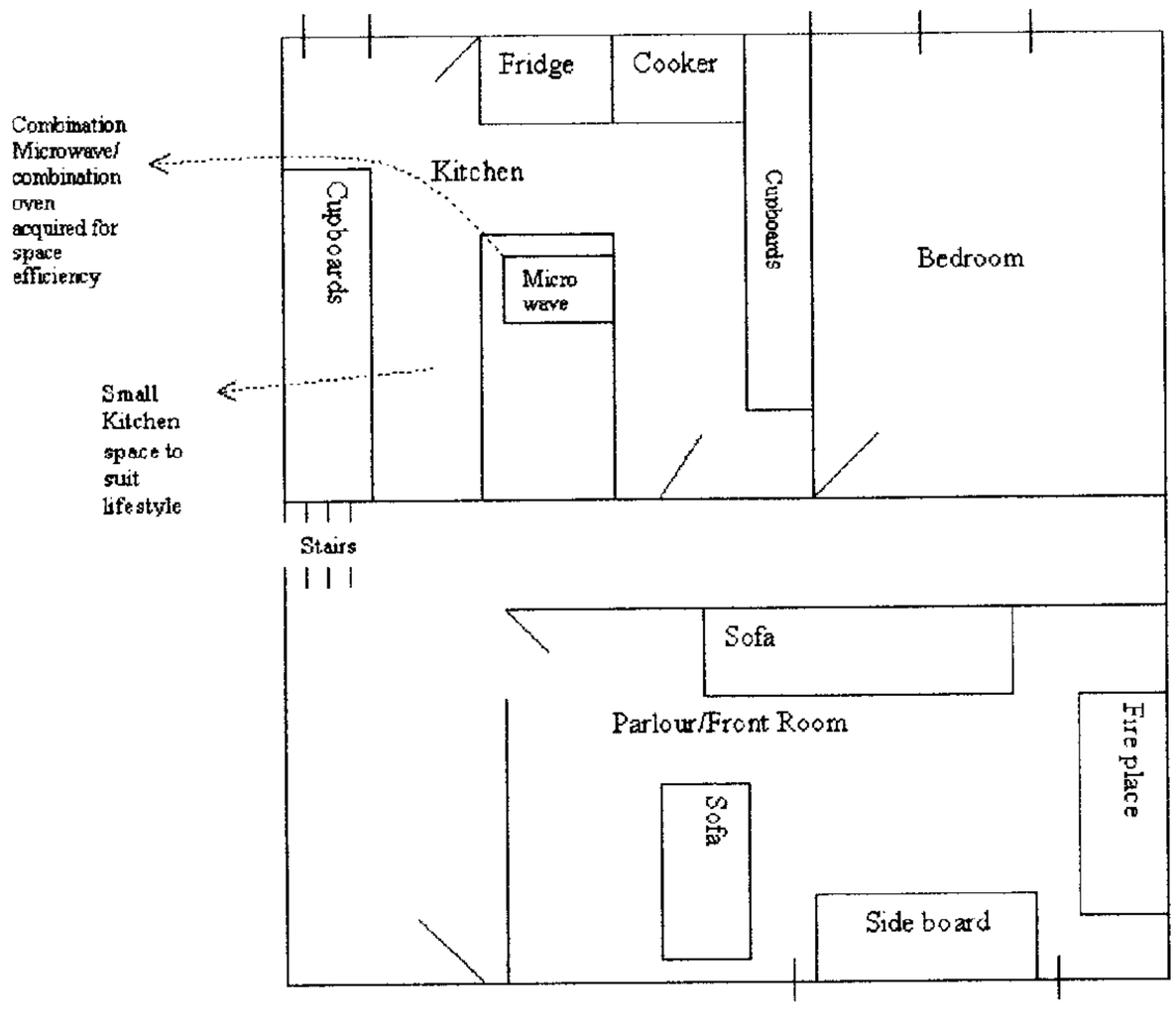


Figure 5.2: The Suttons ground floor

Emily said that she mainly used the appliances and Peter did not make any comment about what technologies he used in the kitchen. The microwave is being discussed in this excerpt:

> *Researcher: The microwave, its position in the kitchen, is there any particular reason for that?*
> *Peter: It's the only place it can go.*
> *Emily: Its not the only place it can go! It can go somewhere else but, it was for the size of our kitchen and we don't have an oven. It's a combination, which saves us from having to have an oven and grill.*

The information they provided showed that it was quite logical that they did not have a standard oven, as a combination device was more appropriate for their lifestyle and would take up less space.

5.2.2 Agnes Reilly

The first workshop tool place on a Sunday afternoon. Agnes stated that filming could only take place in the living room, downstairs hallway and kitchen. The technology tour was, therefore, limited to public areas. The tour commenced in the livingroom.

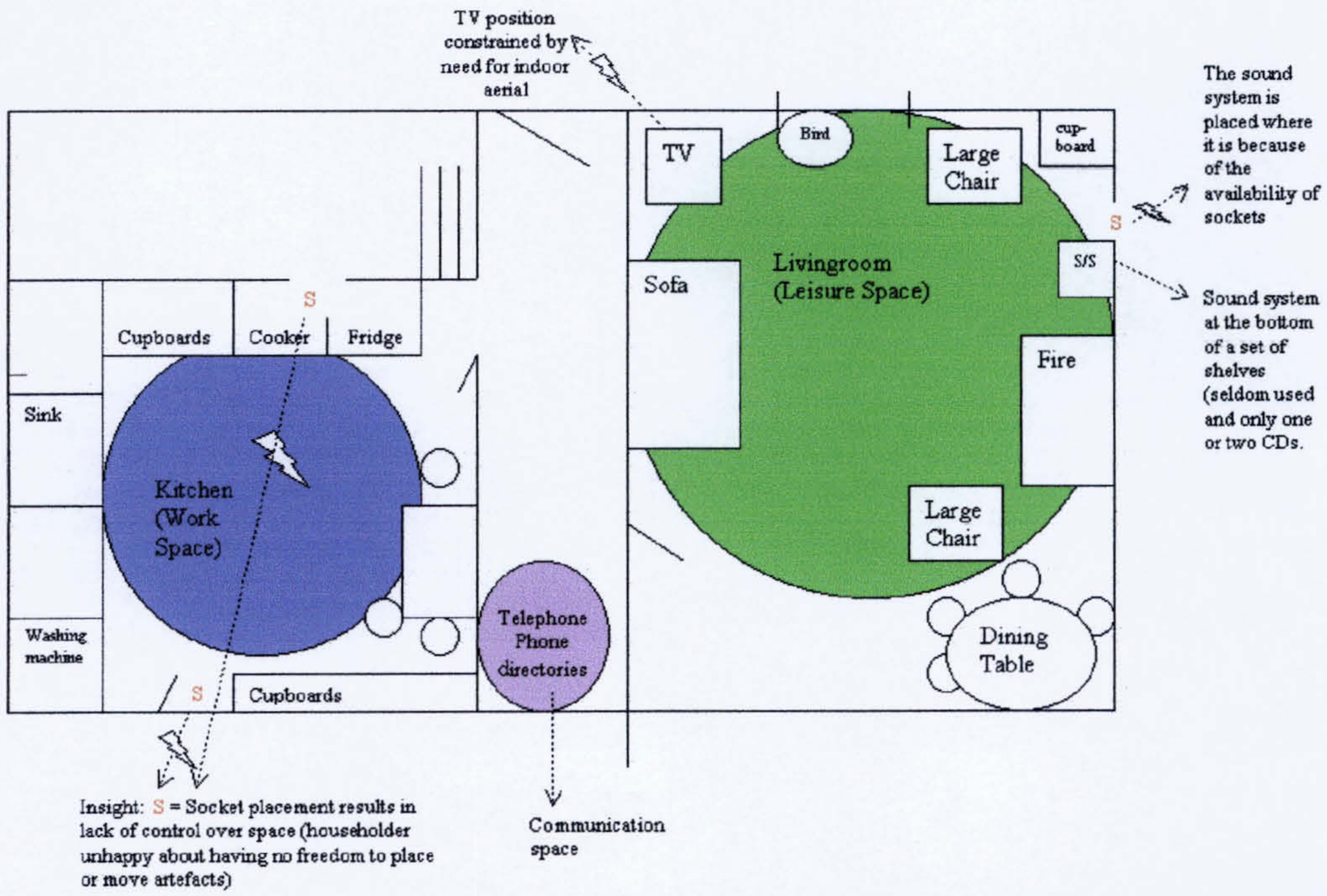


Figure 5.3: Agnes Reilly's ground floor. Access was limited to the ground floor of the home as a consequence no bathroom or bedrooms are shown in this model.

Living room

The television uses an inside aerial, therefore, her choice of position for her television is limited by this. However, when asked if she would change the position, if this were not a limitation, she said that she would not.

Agnes has positioned her sound system according to the position of available electrical sockets. She also comments that she rarely uses the sound system, perhaps this is the reason for its location.

Kitchen

The tour next focuses on Agnes's kitchen. The kitchen contains most of the general appliances found in most homes i.e. fridge, washing machine and cooker.

She is asked whether this is her ideal layout for the kitchen:

> *Agnes: No, you can see it's all been set up for the sockets. See they're stupid there ((Agnes is pointing to some sockets next to the door to the garden)).*
> *Researcher: So if you had been designing this room you would not have had those sockets there?*
> *Agnes: No. They were just put in there, they never used to be there. It's only in the last year that those sockets have been put in.*
> *Researcher: So did you have any input into where the sockets were going to be?*
> *Agnes: No.*

Agnes remarks that the sockets are inappropriately placed and comments that she would have liked to have been consulted about placement when the new sockets were installed.

This technology tour was the shortest conducted. This was due to various factors: being limited to public rooms; only two people being present (the researcher and the participant); and the lack of technological devices. This finding may not be uncommon in older people's homes as, in the United Kingdom, they have been found to have less technology (Hanley, 2002).

5.2.3 The Smith Family

The first workshop was carried out on a Sunday afternoon. The technology tour commenced in the living room.

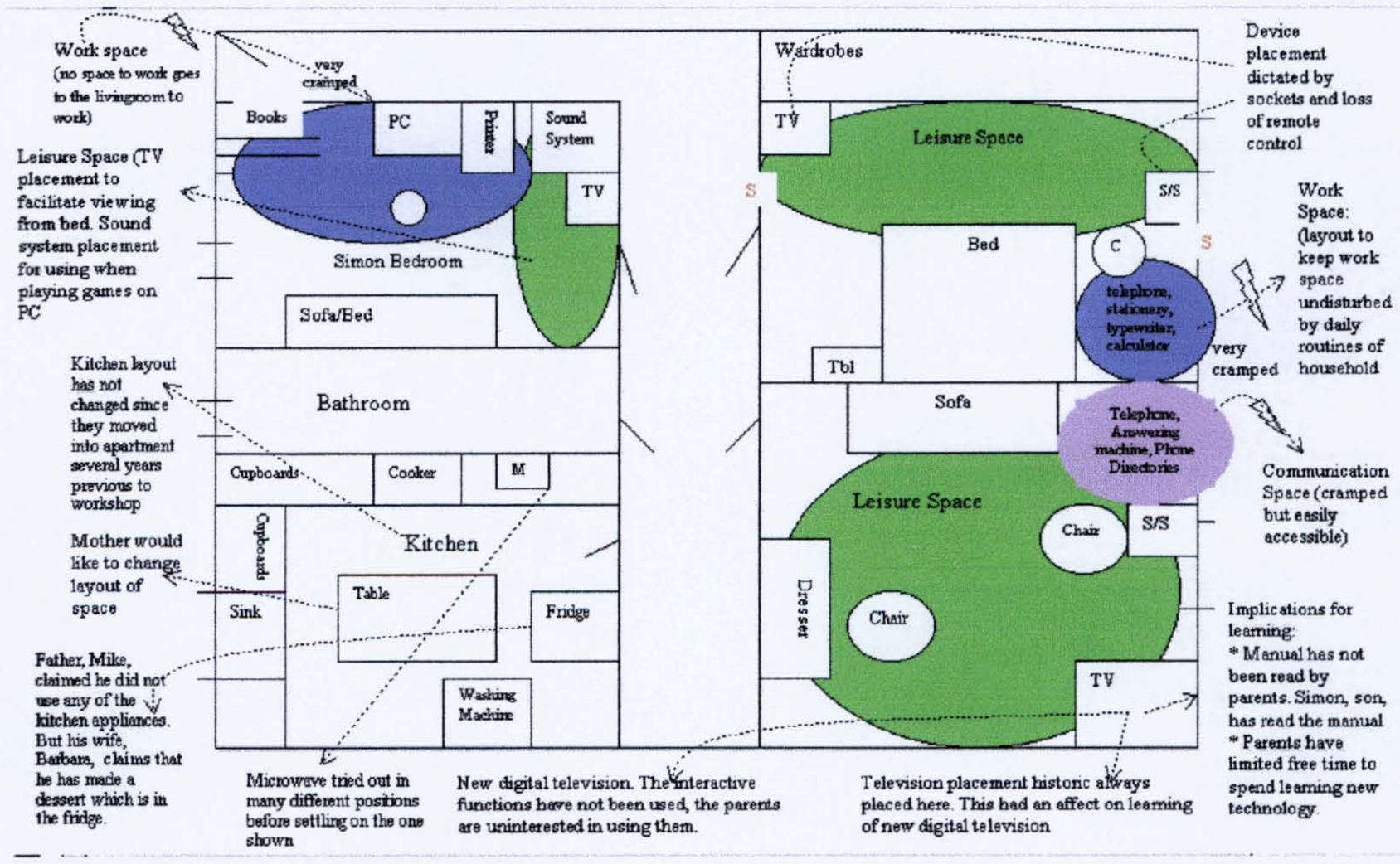


Figure 5.4 Consolidated view of the Smith Home. This figure shows the overall family view of the home.

Living room

Mike commented that the positioning of the television is historic i.e. a television, in this family's home, is always placed in this position in the living room. The father and son both agreed that the room was set out so as to facilitate viewing of the television. Barbara (mother) seemed put out by this suggestion. It can be clearly seen from Figure 5.4, that the room may have been set out for the purpose as all the furniture was orientated towards the television. We then discussed the use of the television and how they had learned to use it. The insights gained from this discussion are shown in the figure above.

Mike claimed that he did not use any of the technologies in the kitchen. However his wife (Barbara), opened the fridge and pointed to a home made dessert, it was quite clear from her inferences, that he had made the dessert, and he looked quite put out by her suggestion that, if it wasn't his, then, she would eat it (Figure 5.4). Mike's claim that he did not use any of the technologies in the home was perhaps rooted in a finding made by Csikszentmihalyi and Rochberg-Halton (1981).
They found that people's relationships with objects in their homes was to a certain extent 'scripted' by their cultures.

That is, how we react to objects and our feelings towards them have already been influenced in advance by the social milieu into which we are born. These excerpts show that it is important to talk to everyone, in context, about their use of technology as someone might say they do not use something when they do and someone else might claim that someone uses a device when they do not (see Figure 5.6.).

Parents Bedroom

Mike talked about his work space and explained why he would not need a word processor or computer. He said that it would be pointless to have them as he only carries out a small amount of work. Figure 5.4 also shows that the reason for the positioning of the work space in this part of the house is that the area remains relatively undisturbed in the daily routines of the home.
The Smiths have the television and sound system positioned in different areas of the room. They explain that this is because of the positioning of sockets and the loss of remote control.

The physical organisation, therefore is not haphazard but well thought out, as the devices have been positioned specifically for the nearness of plug sockets and viewing/using.

It was found that Barbara Smith had some different perspectives on the use of the families technologies and on the spaces contained in the home.

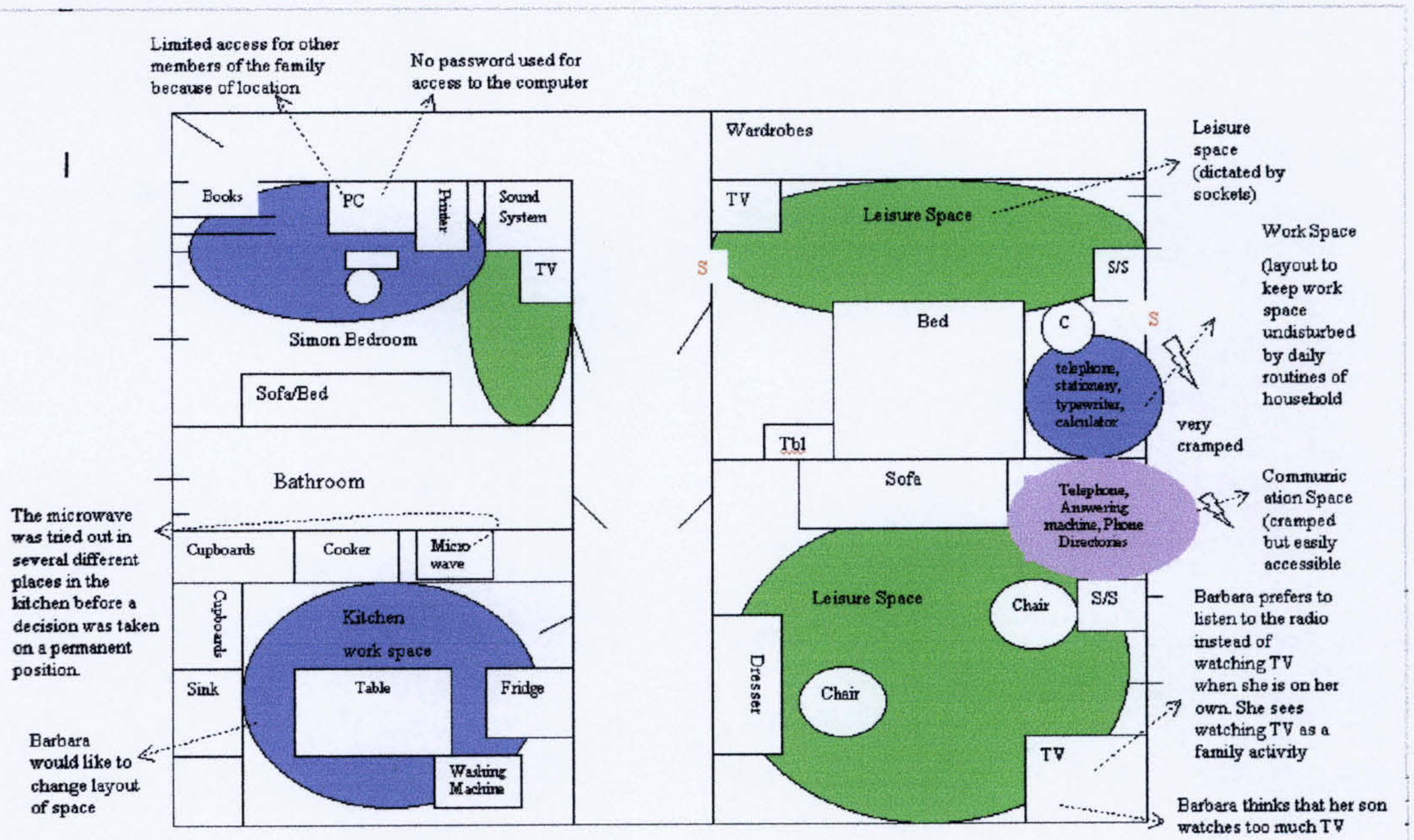


Figure 5.5: Barbara Smith's view of the family home

It would seem that Barbara sees having the television on as a family activity, as she will not object to the TV being on when the rest of the family are present even if she is not actively watching, when she might in fact prefer to have the radio on. The Smiths have not changed the layout or decoration of their kitchen since moving in. Barbara had many ideas about how to change the kitchen but none of these had been implemented. It was not the cost that was preventing the changes from taking place, but the fact that Mike did not have the time, or perhaps the inclination, to change the room.

It is highlighted in Figure 5.5 that the microwave had been tried out in different places in the kitchen, therefore it had not been placed haphazardly in the room but was in a well thought out place. Barbara would also like to have more access to the family computer. However, she has been unable to due to its location in her son's bedroom.

Simon Smith was also found to have quite a different view of the home than his parents.

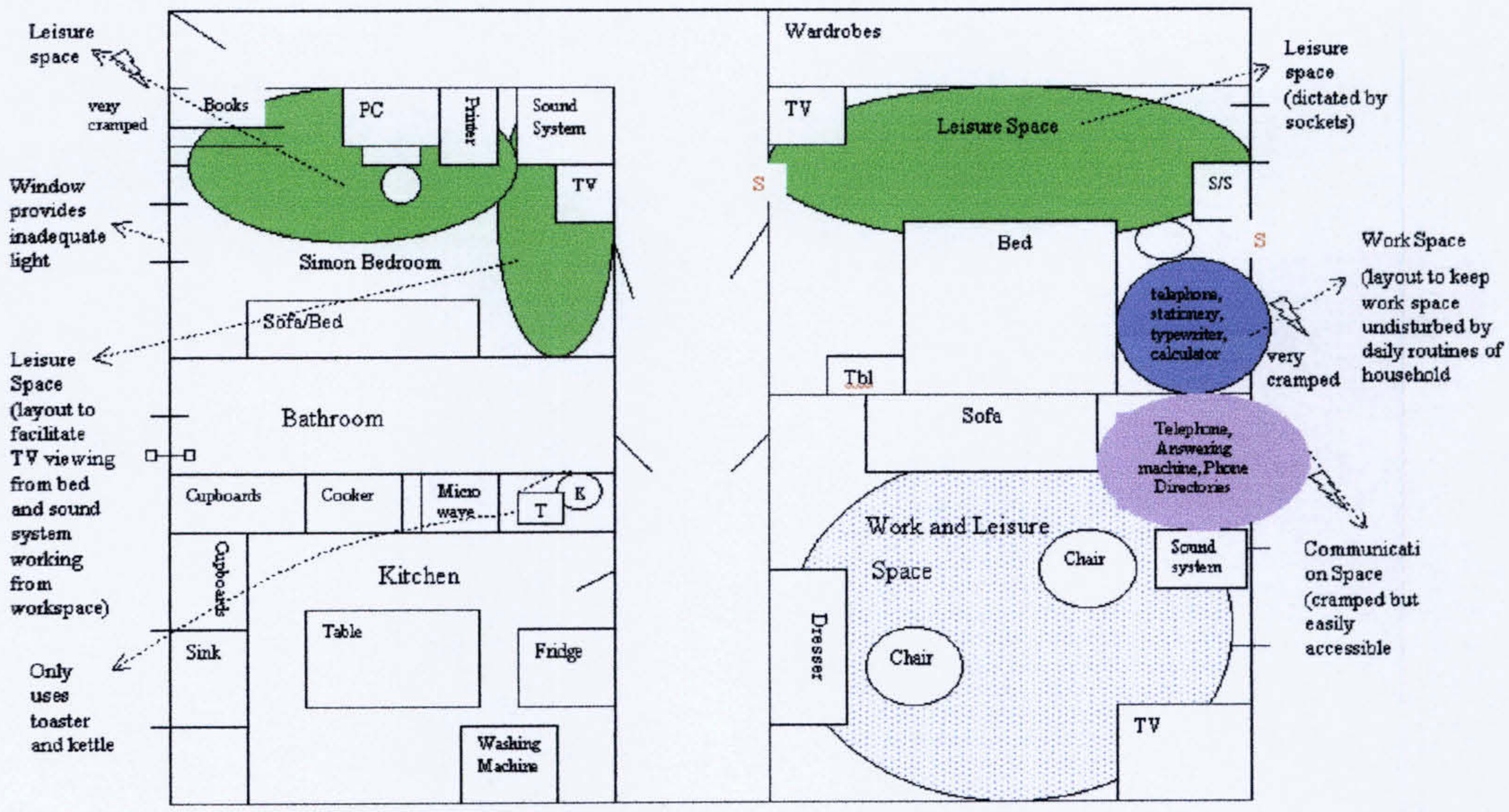


Figure 5.6: Simon Smith's view of the family home

From Figure 5.6 it can be seen that Simon only uses the toaster and the kettle in the kitchen. Simon does not make his own meals or take part in the preparation of food in the home. His mother comments that he uses the microwave, however, he disagreed with her and said that he only used the kettle and toaster.

Simon's bedroom creates the impression that it is ideally set up for studying, however Simon points out that it is not ideal because he lacks adequate light and he prefers the more social atmosphere of the living room.

We discussed in this excerpt the positioning of his PC:

> *Researcher: (.7) You have got the PC here, if you could have it anywhere (.) would you still have it right in the middle there? Or would you rather [Simon: I would have it ower there ((points to the same wall but further along to the left corner)).*

The result of this rearrangement would be a clearer distinction between Simon's leisure and working spaces in his room. The reason that he does not move his PC at the moment is that, while there is room for his PC there is no room for the attendant artefacts.

5.2.4 Petric and Naysmith

The first workshop took place in the early evening, of a working day of the week. On arrival at the house, the two participants, Gordon and Catherine, introduced themselves and Gordon hurriedly tidied away the ashtrays, his partner Catherine asked him why and he commented that it would not be 'classy' to have ashtrays being filmed by the video camera.

Gordon and Catherine had been living in their new home for two months and were in the process of decorating and furnishing. The technology tour commenced in the living room.

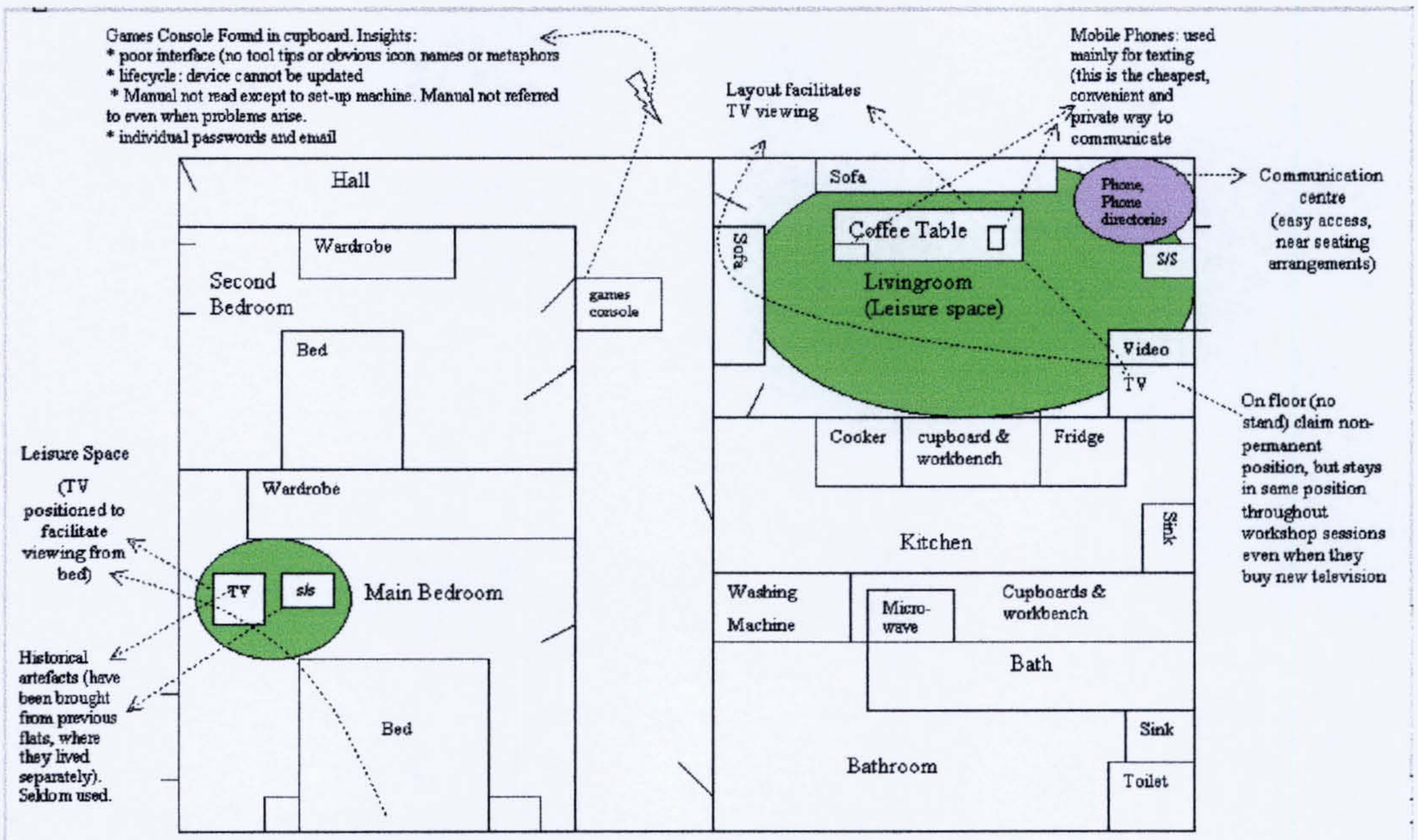


Figure 5.7 Catherine Naysmith and Gordon Petric's Home

Livingroom

The first technology we discussed was the television. The couple stated that the placement of the television was temporary, however, the couch and chairs all faced towards the television making it look like a permanent position. Over the course of the next two sessions the television stayed in the same place and in the final session it was noted that a new television had been purchased and placed in exactly the same position as the old one! Catherine and Gordon's use of their mobile phones was discussed next. The mobile phones were found to be efficient at sending quick notes between Catherine and Gordon and acting as a conduit to facilitate Gordon and his brother keeping in touch.

The different costs of the different functions on the phones (telephone, text, or voice mail) has had an impact on the functions that are used or not used on the phones. Catherine's use of her phone is primarily motivated by the cost of the different functions i.e. it is more expensive to call than to text, therefore the phone is used for texts. A secondary reason may be that texting is less obtrusive when you are in a public place.

Kitchen

We then moved onto the kitchen. Gordon and Catherine have a small kitchen, containing the usual general appliances such as: washer/dryer, cooker, microwave and fridge. Through the scenarios and comments made during the workshop it became clear that they both buy and prepare food jointly. Later on in the study it became clear from Gordon's comments that he wished to know more about cooking.

Bedrooms and Hallway

The tour progressed to the hallway and into the main bedroom. There is a television, sound system, bed and wardrobes in this room, Catherine commented that there was no particular reason for the placement of the technologies and that they rarely used them. The technologies in this room seemed to be spares of the ones in the living room. It could be claimed that they were historical objects in that they may only have been present because the couple, before moving in together, had both had their own apartments.

We moved onto the hallway and Gordon opened a cupboard, which contained general domestic devices and objects such as an iron, vacuum cleaner and cleaning products; no comments were made about these objects. There was also a Dreamcast games console in the cupboard. The console looked unused, as it had a washing basket and other household items on top of it. We discussed the games console and Gordon and Catherine showed me how they used it, the insights this provided are shown in Figure 5.7. These insights show how a positive attitude (e.g. wanting a games console and internet access, and discovering that they could have all this in one package) changed to a more negative attitude because of the poor usability of the device and lack of thought given to the device's lifecycle.

5.2.5 The Cook Family

The session took place in the early evening. The kitchen was next to the drawing room and this is where the technology tour started.

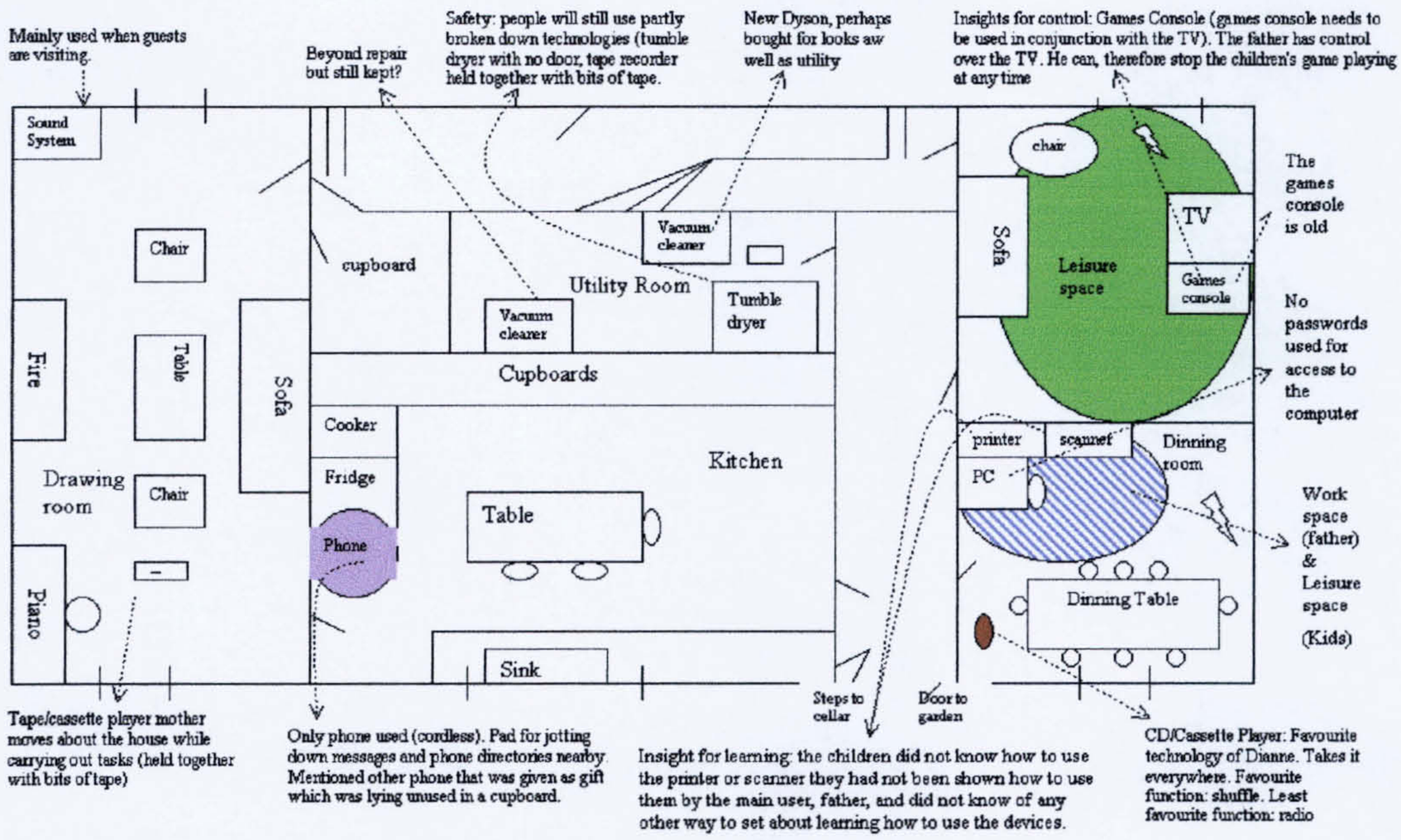


Figure 5.8 Consolidated view of the Cook family home.

Kitchen

The father was very enthusiastic about the technology tour and had taken the concept quite literally. The tour started in the kitchen and Robert (father) started by pointing at each device in turn and saying what it was called, what it did, and who used it e.g. kettle: for making tea and coffee, used by everyone. He went on to say that he did not use any of the technologies in the kitchen except the kettle. The researcher felt that the children in this family were probably too young to know about the technologies in the kitchen, however, they were present when the technology tour was taking place in the kitchen and when questions about the use of various technologies were asked. They did not claim to use or not use any of the devices and quickly left the room. The mother in the family seemed to be in charge of all the home maintenance.

Robert and Sue showed me a phone in the kitchen, which was still in its box, it is a standard push button telephone. They commented that it was a gift. Perhaps the reason they still had it was that they didn't like it but didn't want to give it back or throw it away as it was a gift, hence its non use and its location in a cupboard.

Family room

We moved on from the kitchen and into the family room, which contained a comfortable couch and chairs along with a portable television and games console. We discussed the games consoled. It was found that since the television was the only one in the house and the games console needed to be used in conjunction with the television, a stalemate seemed to have be reached. Since the father was in a position of authority he could stop the children's games at any time. The parents in the Cook family had limited the family to one small television set and it would seem that limiting the household to one television may have had an unexpected effect i.e. that of preventing the children from playing with their games console.

Dinning room

The tour continued into the dining room, which contained a dinning table and eight chairs. Robert Cook uses a corner of the dinning room for work. The PC, printer and scanner are considered to be family devices.

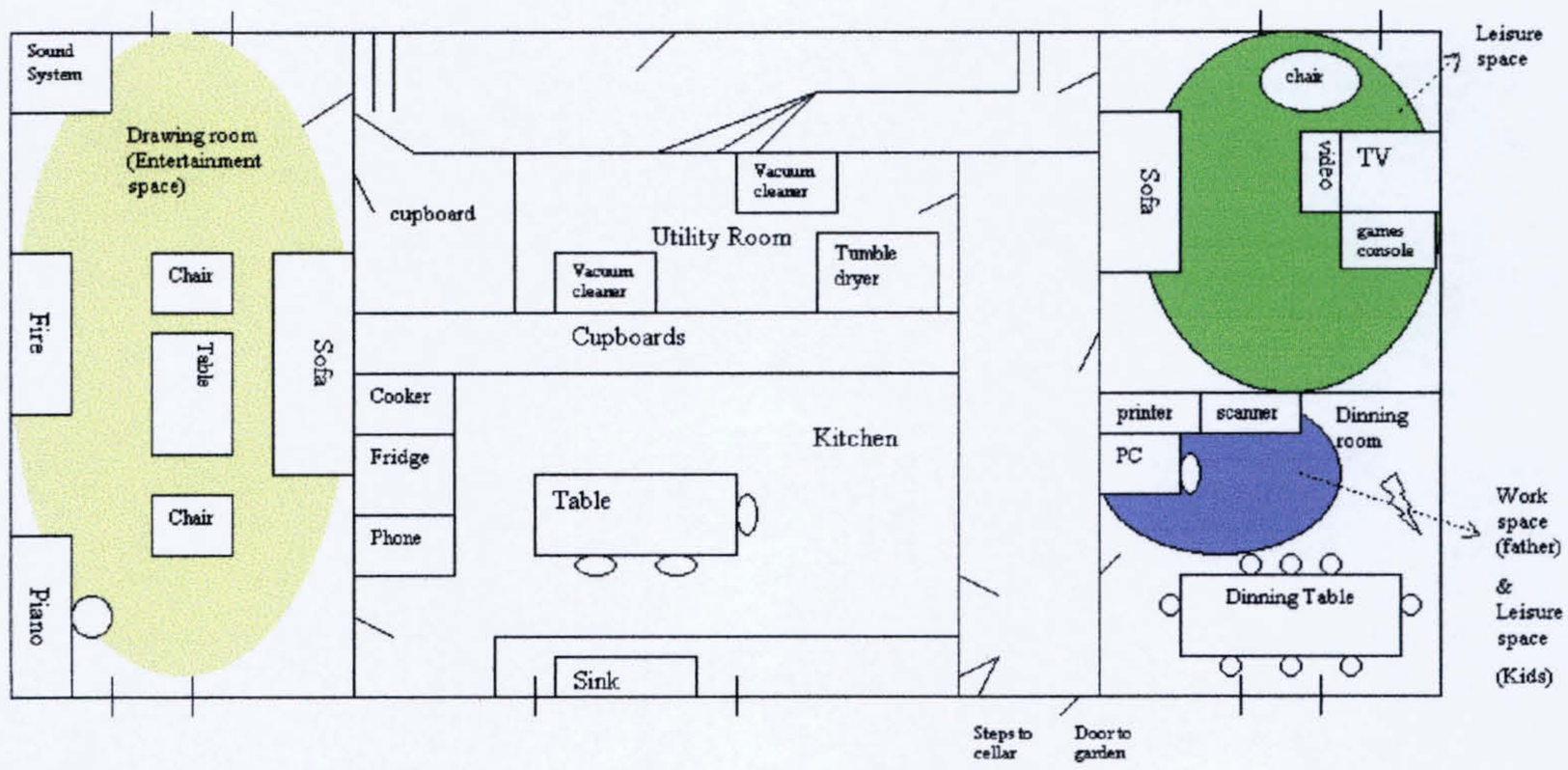


Figure 5.9 Robert Cook (Father) view of the family home.

The sharing of this space has caused some problems as the same space is being used in different ways (see Figures 5.9 and 5.10) by two different sets of family members i.e. the children play games on the PC and leave their games and other debris laying about, the father then comes along and tidies away all their games so that he can have space to work. This in turn means that the children have to search for their games when they come to use them.

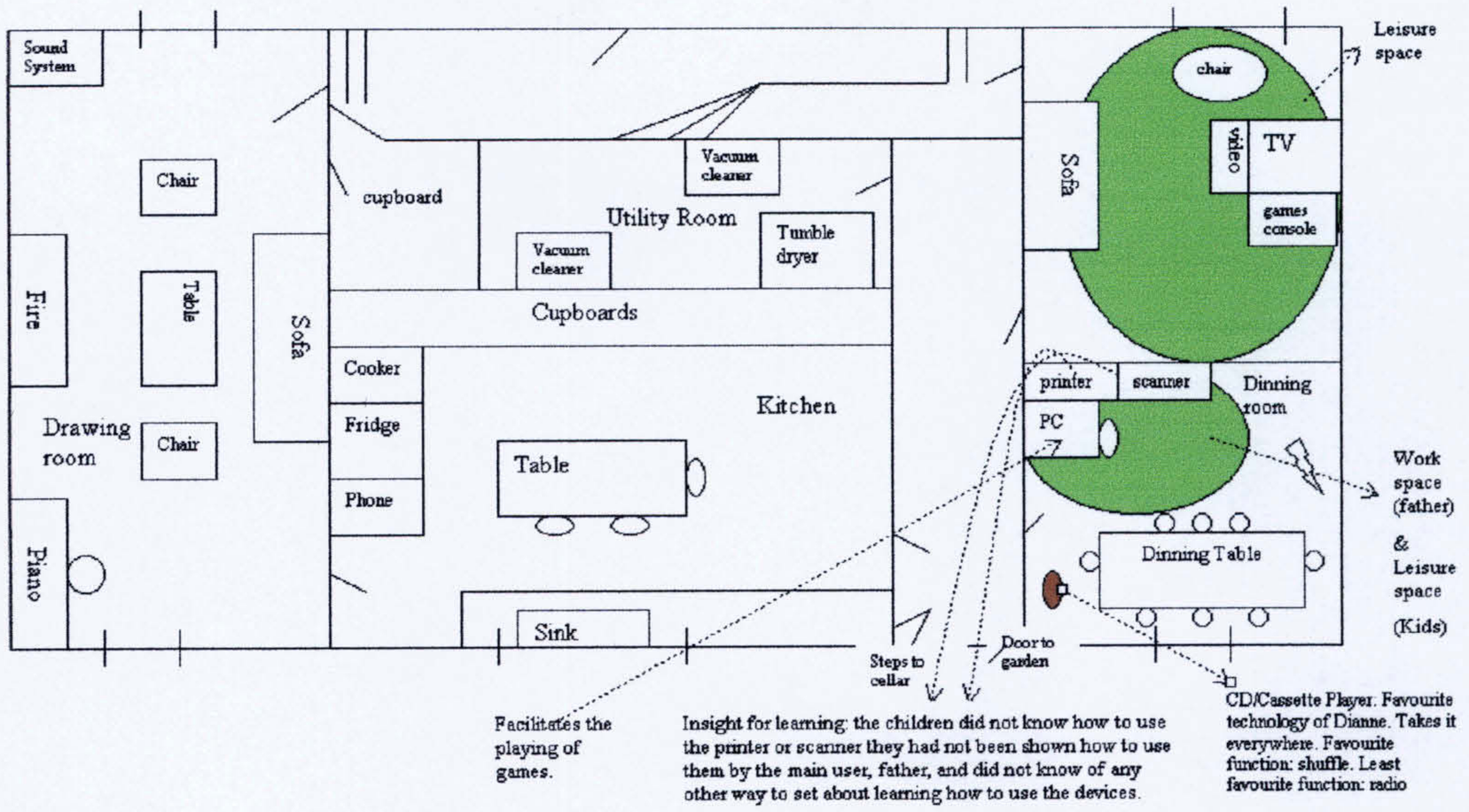


Figure 5.10 Dianne and Tarquin Cooks' (Children) view of the family home

The children switched on the computer and showed me their favourite games and functions. The children were asked about their use of the printer and scanner. The children commented that they did not know how to use them. Both of these pieces of equipment had been bought ostensibly for the family (this is what the father had said), and yet it would seem that no-one had shown the children how to use them.

The parents had put the caveat on the scope of the technology tour by asking that the tour only be conducted in the public spaces of the home, this was of course complied with. However, at this moment in the tour the children of the family had other ideas and decided to go upstairs to try and find any other pieces of technology that may be of interest. One of the technologies brought down was a CD-Player owned by Dianne (Figure 5.10). She commented that she used the CD player a lot (she comments off camera that she takes it everywhere with her). Dianne likes using her CD Player but feels a loss of control when using the radio as radio stations play music constantly and Dianne has no control over what they play.

Tarquin brought down a small toy from his bedroom and is explaining it in this excerpt:

> *Tarquin: It has a switch down here and you can ask it a question ((Tarquin switches it on and it starts talking, in no particularly discernable way, and it nods its head)).*
> *Researcher: So is that what it does?*
> *Tarquin: Yeah*

Researcher: What is it called?
Tarquin: Picachoo. ((Dianne then comes into the room and asks Tarquin if he can go and find his Furby, as her one is broken. Tarquin goes and looks for his Furby but cannot find it)).

The children cannot find their 'Furbies' even though they both have one and they were popular toys the Christmas before. The fact that they cannot find the Furbies, which are less than a year old, is interesting when compared with the children's use (and the very presence in the family room) of an old games console (Atari). The children only showed me toys which they considered 'smart' toys and seemed to exclude ones they did not consider 'smart'. We then all left the room and the tour continued onto the utility room. Sue Cook (mother) explained the use of the technologies in the utility room and her view of the home is shown in Figure 5.11.

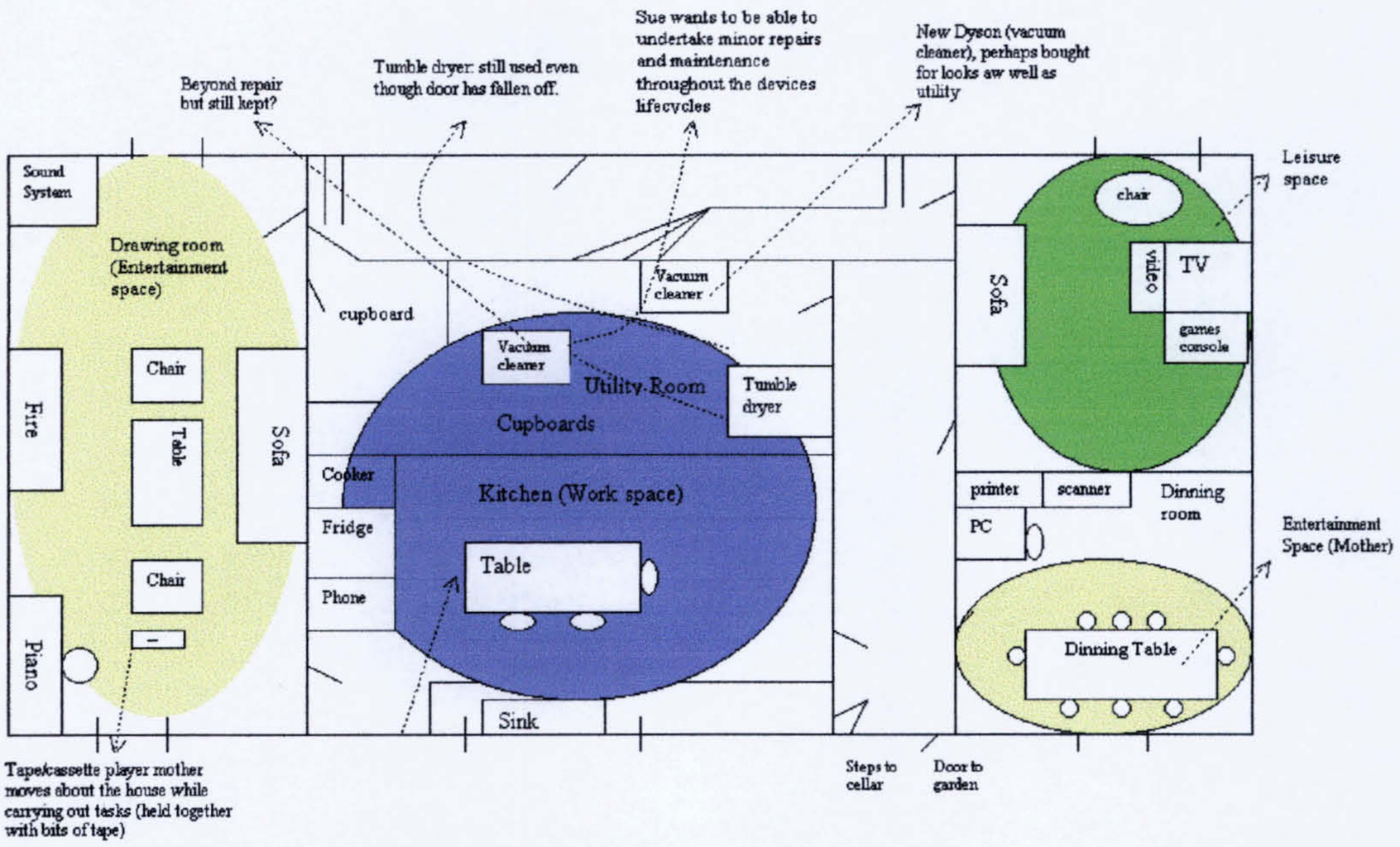


Figure 5.11 Sue Cook's view of the family home

Utility room

For Sue a device was still viable even if it had started to fall apart, therefore, even though for most people a tumble dryer that's door falls off may be at the end of its lifecycle, for Sue, it is still a functional and usable machine.

There was also an old vacuum cleaner in the room which Sue commented was only replaced with a new one because it would be too expensive to repair. Sue's attitude towards the new Dyson seemed to be ambiguous, as if she hadn't quite made up her mind what she thought of it.

The Dyson could be said to have been bought more for its appearance than any of the other devices, therefore it may not be a coincidence that this is the device that Sue was most reluctant to talk about. However, her lack of comment about the device could have been due to the fact that it was new and she had not concretised her thoughts on the device.

Drawing room

The tour moved back into the drawing room and Sue made the final comment of the tour about an old tape recorder (Sue uses the tape/radio player when she is moving round the house cleaning). She still uses this tape-recorder even though some functions are not working (tape) and it has to be held together in places with tape. This finding and others have shown that the life-cycle of a device in the home may not end when a device starts to fall apart (tumble dryer). This illustrates that the usability goal of: 'safe to use' cannot be met in these devices (tumble dryer and tape/radio player). However, all the other usability goals e.g. good utility, easy to remember and efficient, are met in these two devices.

5.3 Future Devices

As a way of orientating the participants towards thinking about new technologies for the home and to aid discussions about technologies for the home, the families were shown pictures of some emerging technologies.

These devices included: the fridge that 'knows' when it is out of milk, the microwave with email, and the i.link which enables users to link-up various Sony products (see Appendix 1 for a full list and description of these devices). The pictures of the devices were spread out either on the floor or a coffee table and the participants were encouraged to read the functions and then make comments about each device. The participants main comments focused on how they could potentially use the devices. Each device has been annotated with the families comments (next to each comment is the name of the person who made the comment). Sometimes the participants needed encouragement to start a discussion about the devices, when this happened each picture in turn was held up and the functions list was read out. The participants were then asked if they would like the device or could see themselves using it.

5.3.1 Smart fridge

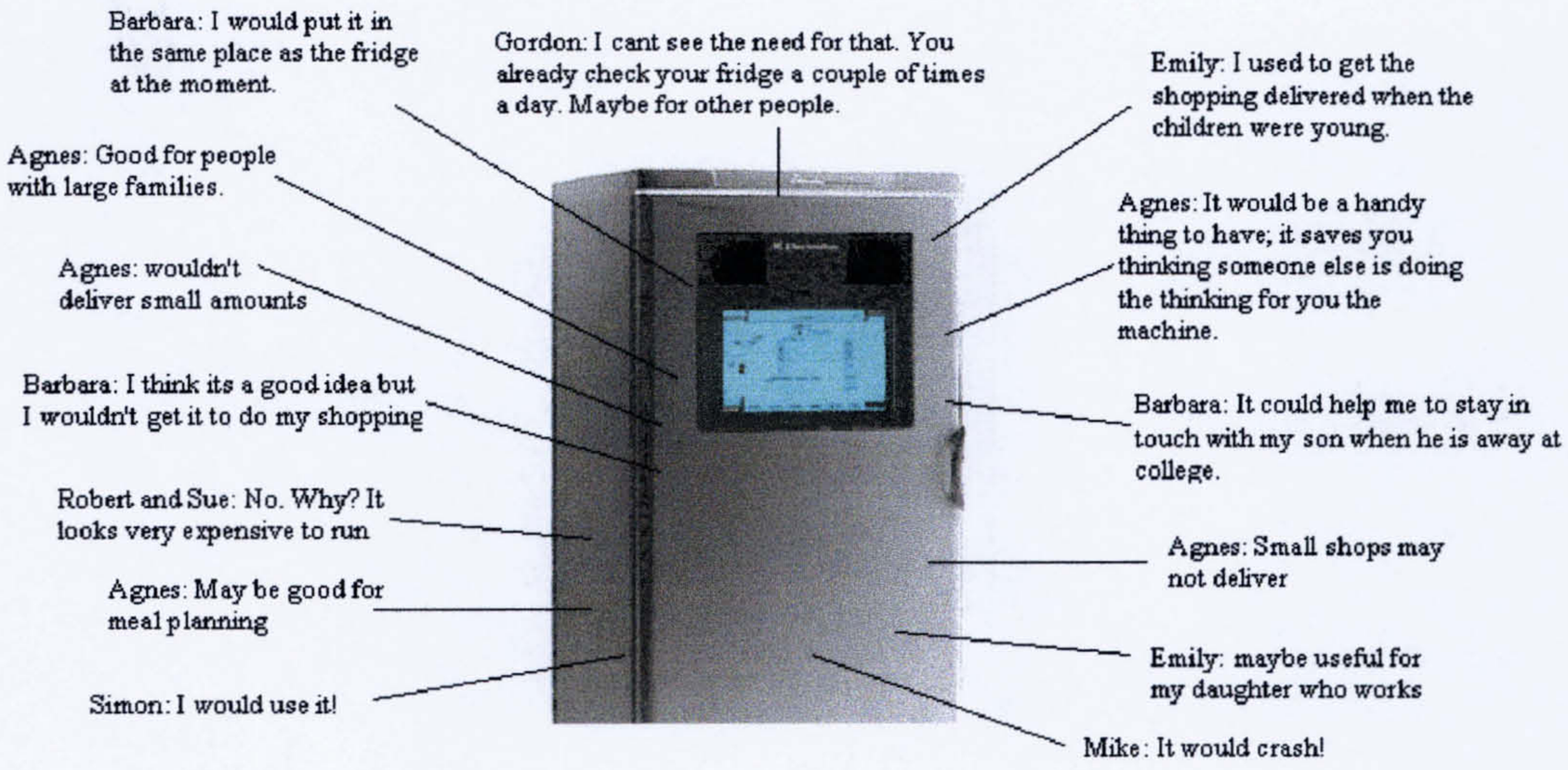


Figure 5.12: Electrolux Smart Fridge (Main Features: Internet access, Interactive shopping, Banking, Meal planning and food warning system. Additionally the fridge has the ability to give warnings about food freshness, make recipe suggestions and run diagnostics on other kitchen equipment).

Emily remarked that the smart fridge would be of more use to people, such as her daughter, who are working. The fridge also prompts Emily to recount a story of how she used to have her shopping delivered, when she had young. Emily's story reminds us that there is nothing new in getting your shopping delivered to your home, it is in fact something, which was once quite common, but declined because of the growth in car ownership and supermarkets. In a reversal of this supermarkets are now encouraging people to order their goods on-line and have them delivered to their homes. However, Agnes points out that supermarkets may not want to deliver shopping to people like her who only buy small amounts. Most supermarkets that offer home delivery at the moment (Tesco and Sainsburys) have the proviso that you must spend more than a certain amount or pay for delivery. Since most senior citizens are careful with their money and also don't buy a lot of goods, it could be surmised that the delivery aspect of supermarket shopping would not be accessible to them. Agnes also mentions that she walks to and from the shops, therefore, this walk is part of her daily routine and helps keep her fit and healthy.

Barbara liked the smart fridge concept even though as she has said she likes shopping and one of the main features of the device is the ability to shop on-line.

She thinks that she would like to adapt it so that it would track all her foodstuffs. Barbara comments that she could use the fridge in the future as a way of keeping in touch with her son when he goes to college. Emailing is not something Barbara does at the moment either through the family's home PC or digital television. Barbara seems to be more comfortable with the idea of emailing her son via a fridge than via a PC or television. One reason could perhaps be her familiarity with fridges as opposed to PCs.

Simon Smith (teenager), comments that he would use the smart fridge. This is an interesting comment as Simon does not use or take an interest in the majority of the devices that are in the kitchen of his home at the moment.

Mike remarks that any technology is bound to crash at some point. He points out that this is what he thinks would happen with the smart fridge and future devices in general. Barbara has the opposite view of Mike and is convinced that the system would not crash. Barbara comments that she thinks that she would be able to put the smart fridge in the same place as her old fridge. It could be concluded, from this, that she sees this fridge as the same as her old fridge, but with added benefits.

Both the Cooks and Gordon and Catherine laughed when they saw the smart fridge and interactive microwave and could see no need for either device. The children looked especially uninterested in devices that could be construed as being for the kitchen e.g. interactive microwave and smart fridge.

5.3.2 Home information centre (HIC)

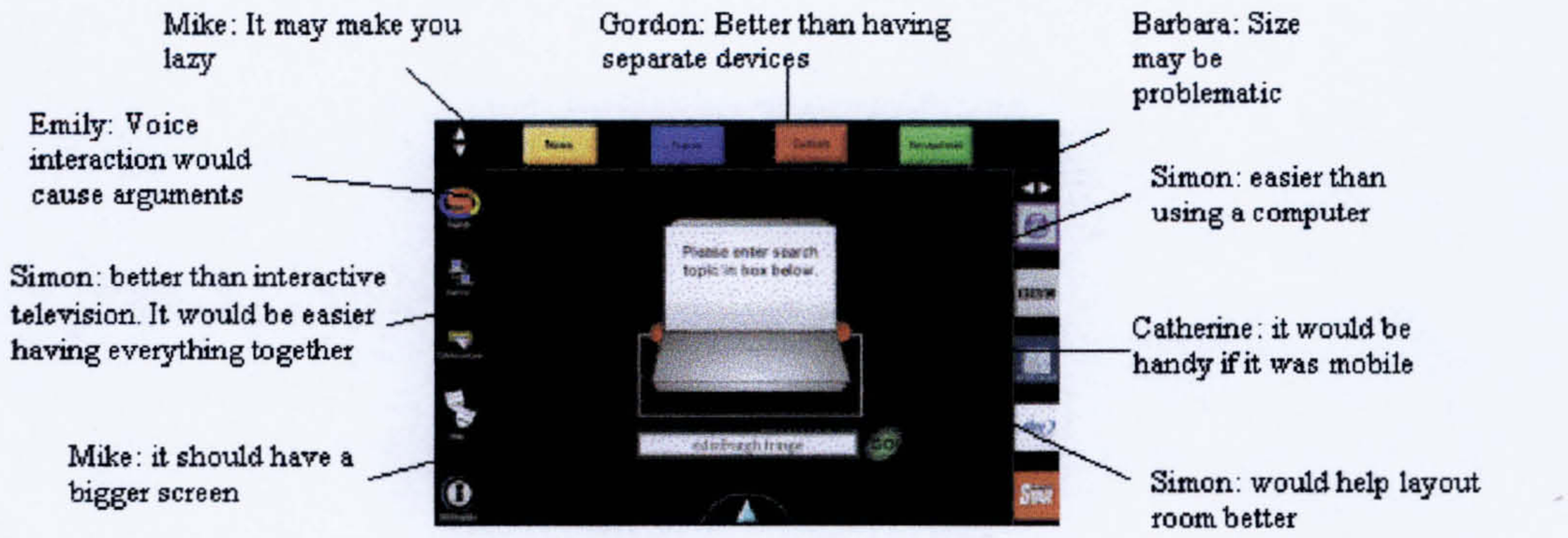


Figure 5.13: The HIC (Main Features: e-mail and internet access, television, voice activation, MP3 player, and information services).

Mike Smith comments that he would like a bigger screen, however, Barbara Smith comments that she does not want a large screen. Therefore, quite a small, seemingly innocuous, change like changing the size of a screen may cause friction in the home.

Simon decided that he would like to keep the picture of the HIC and live with it until the next workshop. He was given the picture and some Post-its to fill in. He said that he had chosen the device because it would be better than having separate devices. He also has quite a small bedroom which could quickly become cramped, therefore, a device which combines some of the features of his separate devices into one device would give him more space. This could perhaps be one reason why he chose the HIC.

Emily's comment highlights that the use of voice activation in the home may cause arguments and additionally may have similar control connotations to the television remote control. Mike was also interested in voice activation but he had a more positive attitude towards it. He seemed to be aware of there being voice activation technology, however, he could be under the impression that he could freely talk to the machine (as seen in many science fiction television programmes, such as Star Trek and Red Dwarf).

Gordon and Catherine liked the concept of the HIC and thought it would be better than having separate devices. It would also mean that they did not have to acquire a PC.

5.3.3 Intel Video Phone

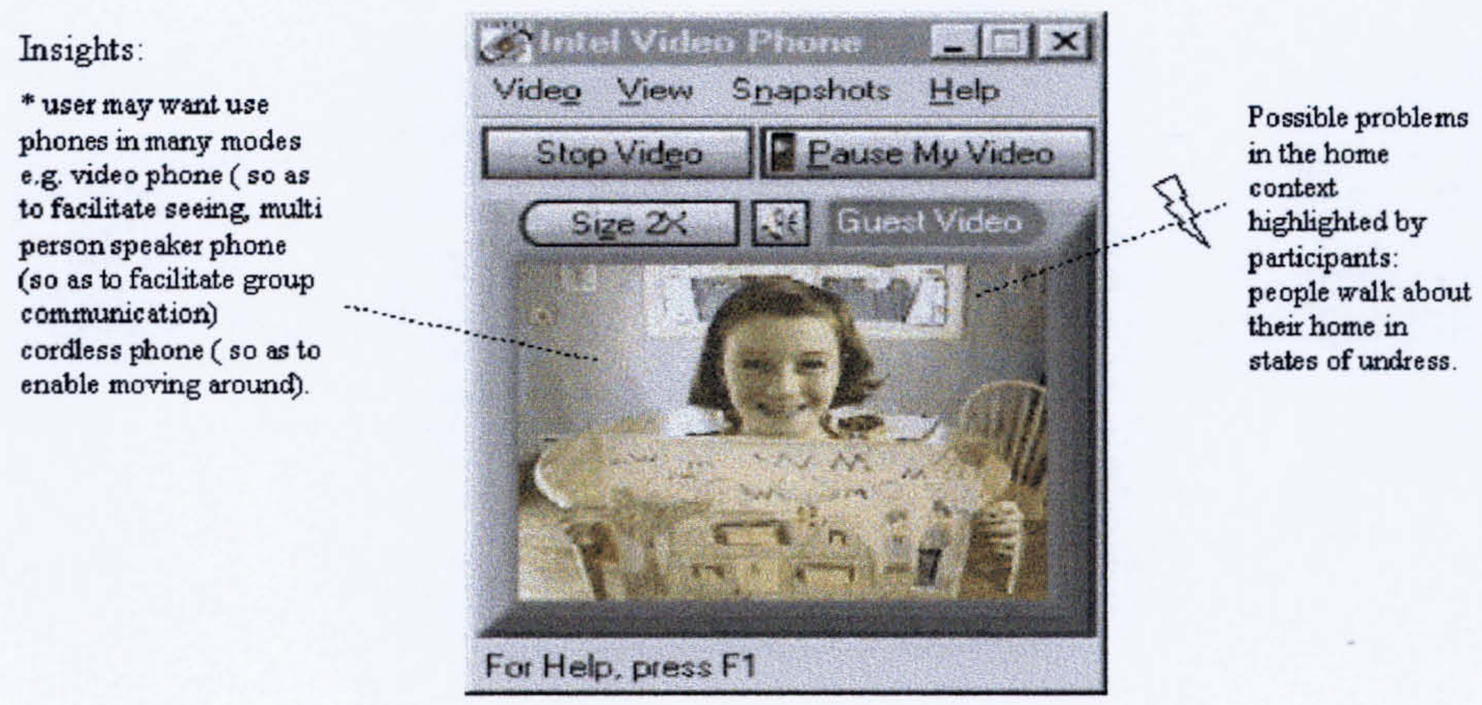


Figure 5.14: Intel Video Phone (Main Features: video screen, stores up to 150 names and e-mail addresses, address book has a 'search' facility).

The comments made about this device were made during the scenario part of the first workshop. The insights were ones made in a general way about the use of a video phone in the home. As can be seen above some interesting insights and possible problems with use in the home setting were highlighted

5.3.4 Interactive microwave

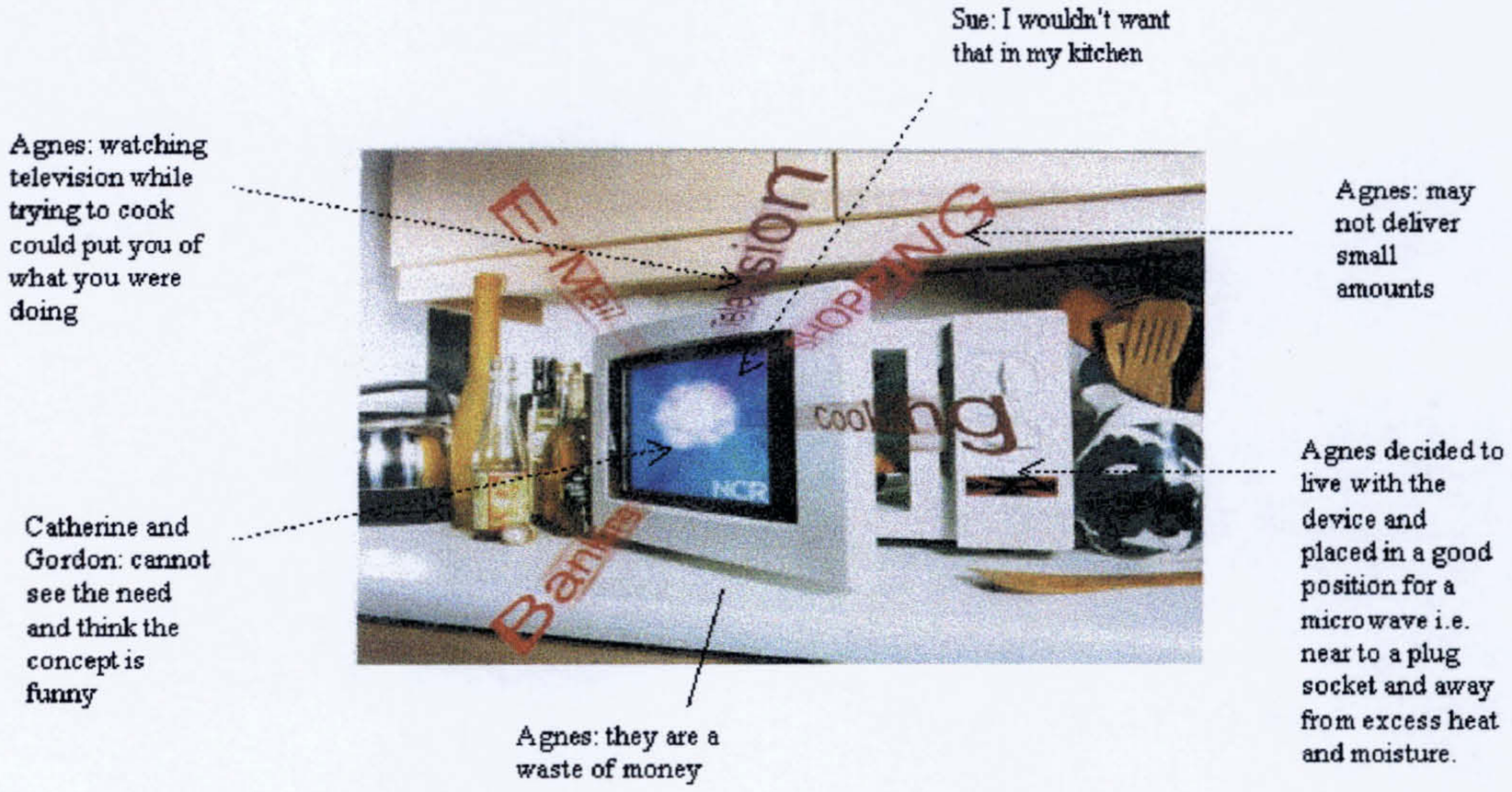


Figure 5.15: NCR Interactive Microwave (Main Features: home shopping, home banking, e-mail and internet service, television, cook and bar-code reader).

Agnes makes a very relevant comment, in the figure above, about the interactive microwave. She pointed out that a person could quite easily become engrossed in their favourite programme while waiting for their 'Tikka Massala' to heat up. Agnes heavily criticised the concept of the interactive microwave, therefore it came as something of a surprise that she decided to live with the interactive microwave until the next visit. When Agnes was asked where she would like to locate the picture of the interactive microwave. She said the kitchen. She took the device and positioned it where she wanted it to go. The place she chose would indeed be a good position for the microwave as it would be located away from excessive heat or moisture and next to plug sockets. Agnes had a good location in her kitchen picked out for a device, which was only a picture.

Catherine and Gordon said that they could not see the point of some of the features offered by the microwave or smart fridge e.g. the interactive fridge's ability to alert the user as to food freshness. As Gordon quite rightly pointed out, we go into our fridges on a daily basis, as a matter of routine, and our senses i.e.

smell and sight would alert us as to whether something is off; do we need a device which will provide us with information we already have? As Norman (1999) said 'what is the added benefit?' to their lives, it would seem that there would be none.

5.3.5 Sony i.link

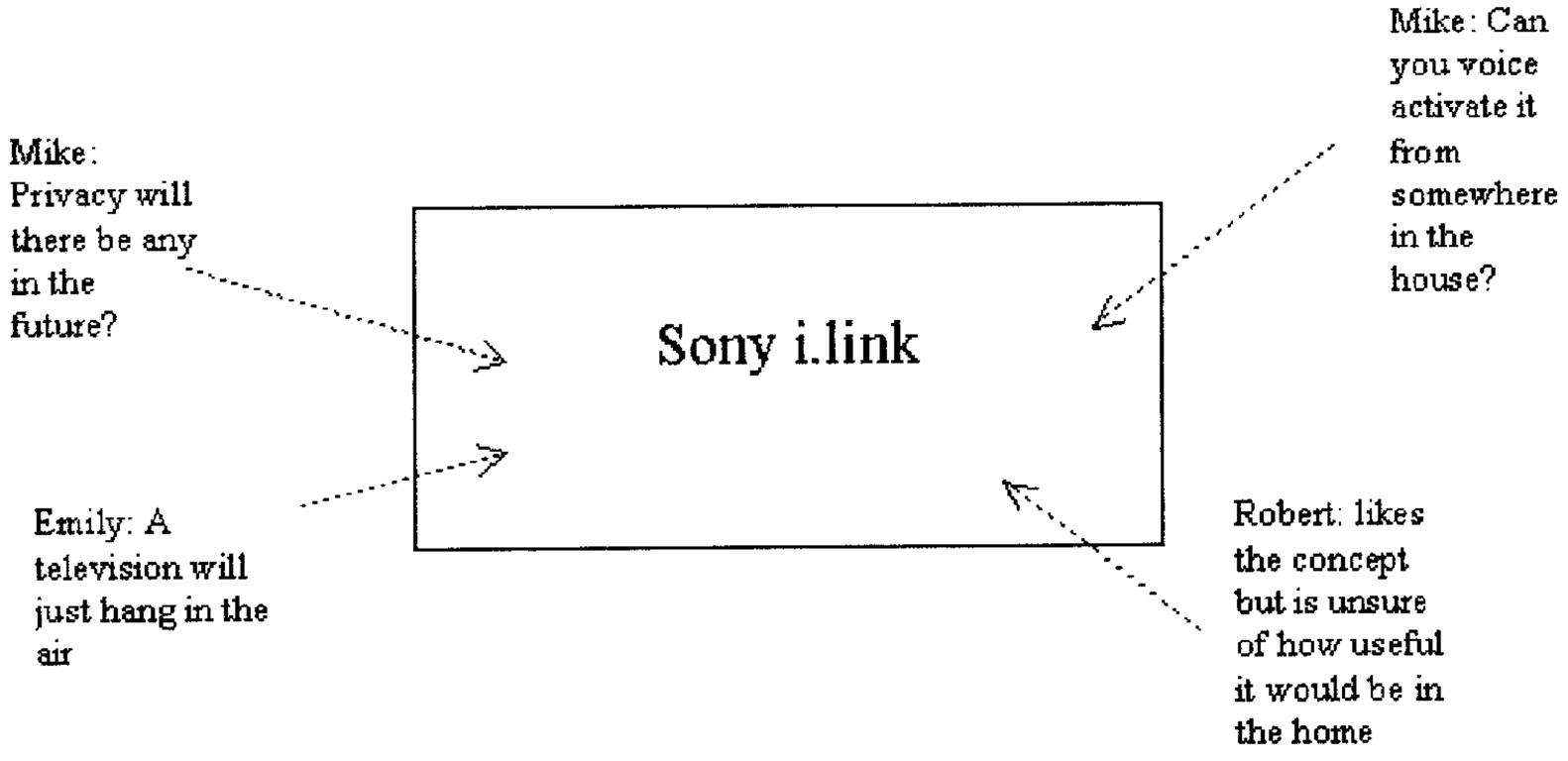


Figure: 5.16: Sony set-top terminal for home networking (Main Features: High speed Internet access, easy control of home networked devices equipped with an i.Link. interface, such as Mini-Disc recorders and camcorders of the future, video telephony over a cable network. Sony is still working on the actual device itself so no picture was available).

All the families seemed to have a very positive attitude towards the idea of wireless technology and the ability to move technologies about their home. The one family that seemed to have the least positive attitude were also the family with the largest home.

During the discussion of the i.link Mike remarked that he thought that nothing is going to be private in the future and that this included people's homes. Mike did not seem to feel the need to concern himself with whether or not these devices would invade his privacy.

Robert's comment would suggest that because this type of technology is so new it is difficult for some people to think of a 'need' or use for it in the home.

5.3.6 Wireless Application Protocol (WAP) enabled Phone

Figure 5.17: Nokia Wireless Application Protocol (WAP) enabled Phone (Main Features: internet, e-mail, address book has a 'search' facility, qwerty keyboard, calculator, interactive text services, for home banking, shopping and information services and stores up to 150 names and e-mail addresses).

Emily commented that in the future she thinks everyone will have mobile phones and that we will no longer use land lines. She was quite happy with this idea as long as mobile phones become cheaper. However, Peter seemed more unsure and was concerned about possible health issues.

Gordon commented that he thinks that the screens on the internet enabled phones are too small. He suggests that the size of screen compares badly with a PC screen and comments that it would be limited as there is only so much information that can be displayed on a very small screen. This is a pertinent issue and one which manufacturers are grappling with at the moment i.e. is it possible to show the internet in a 'good enough' way on a very small screen.

The Cook family pointed out that they can surf the internet and send e-mail from their home PC and would, therefore not 'need' a phone with internet access.

5.3.7 Discussion

While the devices did attract comments directly attributable to an individual device, discussions did take place about some of the common functions across devices. For example, the Suttons realised that most of the future devices have email, this sparked a general discussion about email. In this excerpt Emily is commenting that she is unsure of the benefits of emailing through her television:

> *Emily: No, we wouldn't want that. To punch out an email on that (indicates towards the television remote control)) would take you forever.*

This is a valid point and one that has been recognised by some manufacturers e.g. some manufacturers include wireless keyboards with their digital television. However, it is debatable whether or not it is comfortable to sit in an armchair with a rigid plastic keyboard and type an email.

Peter Sutton remarked during this discussion that he doesn't understand the payment mechanism for paying for the internet:

> *Peter: I don't understand how we pay for all that internet, through our TV...*
> *Researcher: Would you be interested in having the internet?*
> *Emily: Not really because we are trying to keep costs down.*

This excerpt showed that Peter and Emily were concerned about the costs associated with the internet. The main issue for Peter seemed to be the running costs of the internet and understanding how the internet is paid for.

The Suttons then discuss how their daughter and grandson found information for them on the web.

> *Researcher: Have you ever thought that you could do that here. I mean access the internet?*
> *Emily: It would be quite good, because.. for finding information when I was having my hip done, J**** found out all about it for me.*

Peter is talking in the following excerpt about how he and his grandson were having a chat about his father who had joined the army when he was underage.

His grandson suggested that they look on the web to confirm his great grandfather's story.

> *Peter: So K** went on the internet and got all the information immediately. Who was all there, what ships were there, how many rounds were fired, how many folk died, and how many lived. All the information was on the internet, it was very interesting to see that, instead of going to a library and looking for a book.*

Peter found the information on the internet interesting and commented that it was a way of finding information without having to go to the library and look for a book. Emily went on to say that she may have had email if she had still been at work, but cannot see the need for it now that she is retired. Emily's comments show that, for some people, email is still viewed as a workplace form of communication. These excerpts show that the Suttons can see the benefits and drawbacks to having the internet in their home.

Mike Smith commented that for him there were two main drawbacks of the future devices:

> *Mike: You've got to know if you could use them right... and the running costs.*

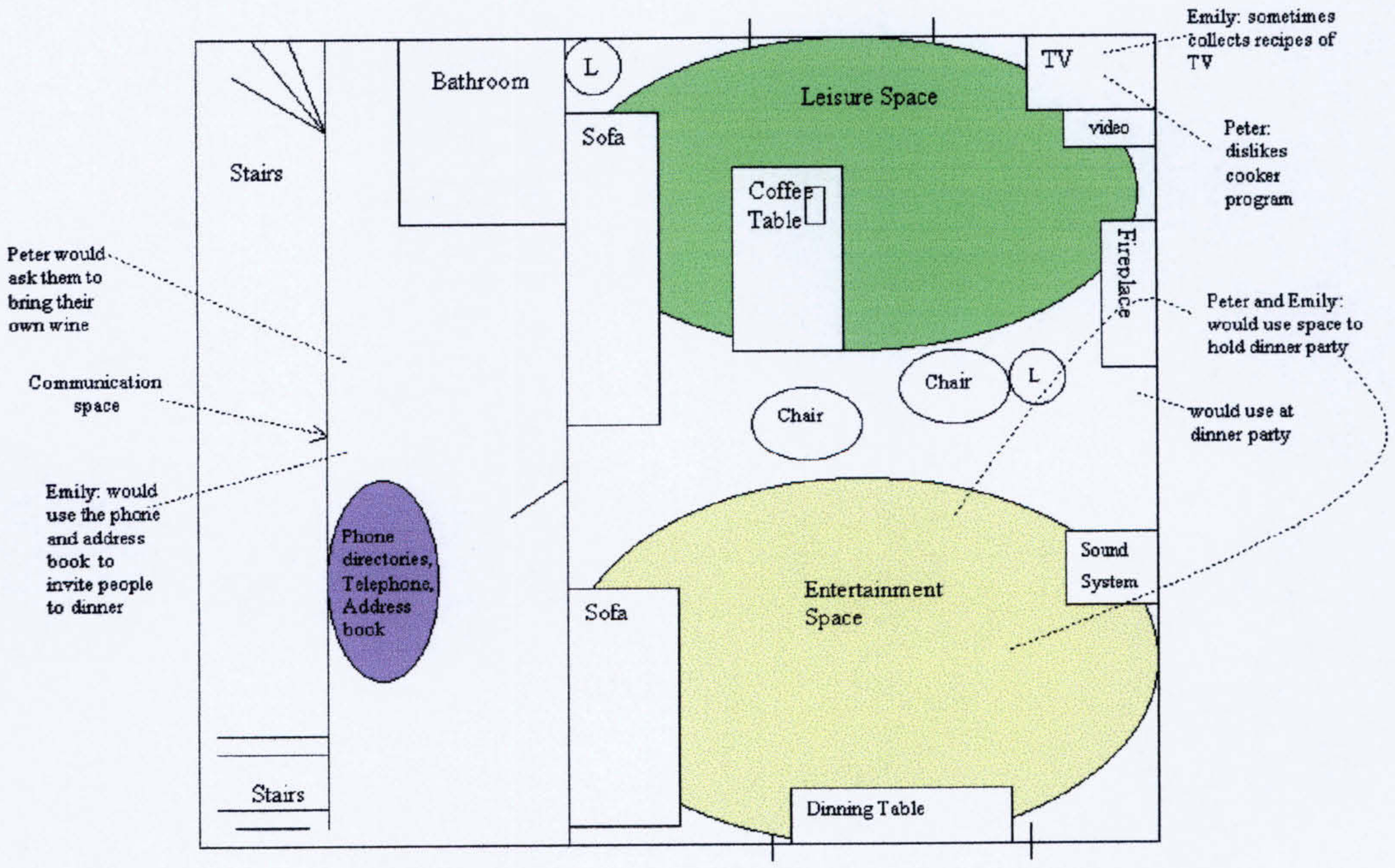
Mike's comment highlighted that the learning and running costs of a device are of primary concern to him.

5.4. Scenarios

Two scenarios were used in the study. In one, the participants were asked to work through a scenario of organising a dinner party, the 'guests for dinner' scenario, in the other they were asked to work through a scenario that tasked them with arranging a night out with friends in the 'what shall we do tonight' scenario (See Appendix 2). The researcher presented the participants with the scenarios and asked them to choose one and work through it while speaking out loud. They were asked to comments on which artefacts they would use in their homes at the moment to help them carry out the task and also to consider using any future devices to carry out the task.

The Cooks did not take part in the scenario part of workshop one. The parents felt that the children would not understand the purpose of the scenarios and may become bored and restless. As a consequence none of the Cooks undertook this part of session one.

5.4.1 The Suttons



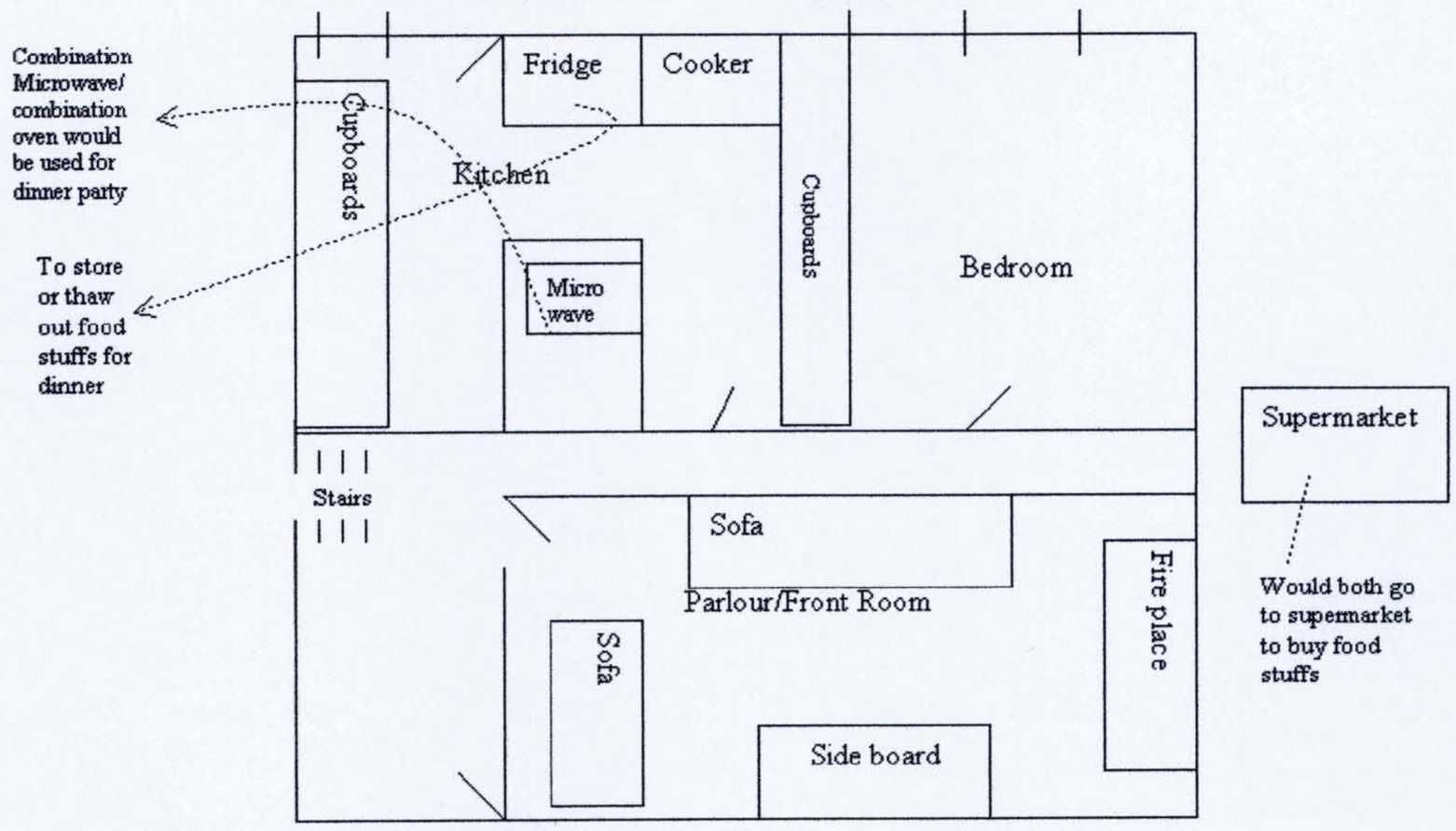


Figure 5.18: Peter and Emily Sutton ' Guests for Dinner Scenario'

The 'guests for dinner' scenario was chosen by Emily and Peter Sutton. They started by explaining how they would go about contacting people. They worked through the scenario mentioning as they went along what artefacts they would use and tasks they would undertake, this is shown in Figure 5.18. Emily Sutton is more than happy with the devices she uses at the moment to organise dinner parties. They both mention keeping costs down, in one of his comments Peter said that he would ask people to bring their own wine.

5.4.2 Agnes Reilly

The 'guests for dinner' scenario was chosen by Agnes.

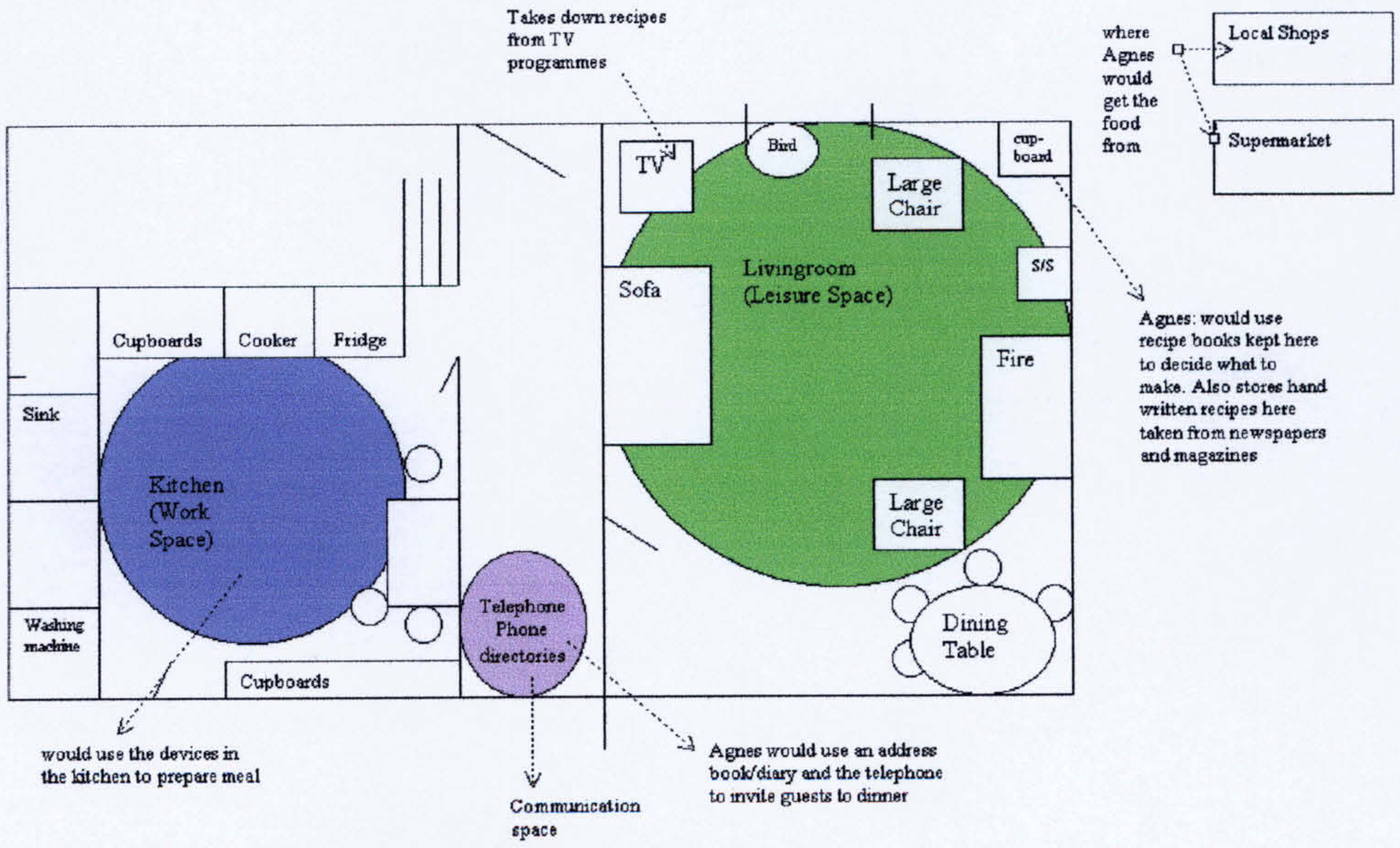


Figure 5.19: Agnes Reilly 'Guests for Dinner Scenario'

The scenario helped to confirm the technologies/artefacts that Agnes uses e.g. a diary which acts as a combination device, that of diary come address book, and that she is happy with them.

5.4.3 Simon Smith

Simon chose the 'what shall we do tonight' scenario, which asked him to imagine he was trying to organise a night out with friends.

Figure 5.20: Simon Smith 'What shall we do tonight?'

Figure 5.20 shows that Simon is content with the tools he uses at the moment to carry out these tasks. But that he can envisage using other devices in the future.

5.4.4 Barbara and Mike Smith

The 'guests for dinner' scenario was chosen by Barbara and Mike.

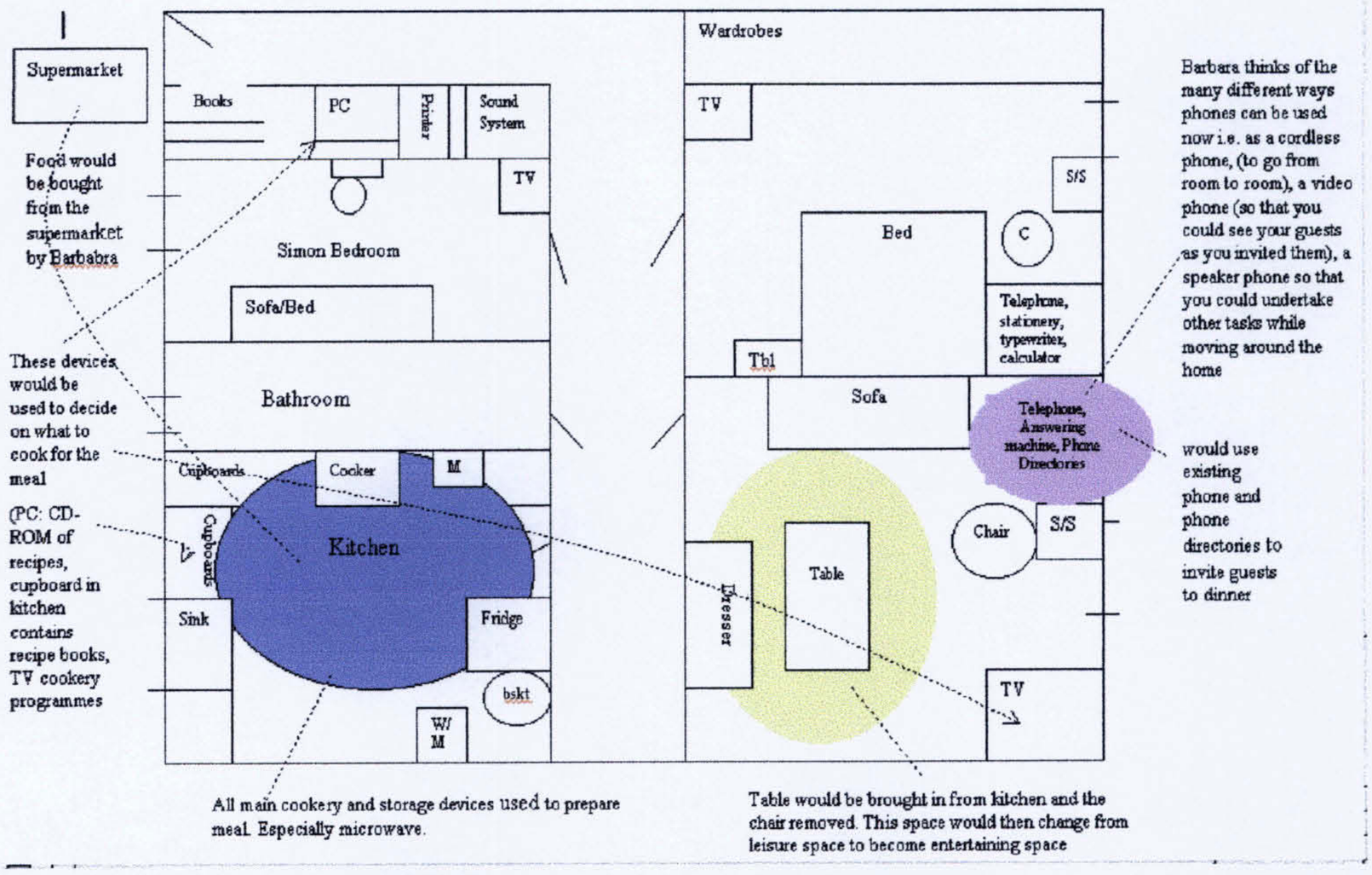


Figure 5.21: Barbara and Mike Smith 'Guests for Dinner Scenario'.

Barbara is happy with the phone she currently has as she can walk freely from room to room, but she is interested in exploring the concepts of some devices e.g. the telephone.

Barbara made the following remarks, about internet shopping, during the scenario session (which was a feature of more than one of the future devices just discussed):

> *Barbara: I just dinnae like the idea...e::h this internet shopping or that really and I could'nae see I would even in the future ((she is shaking her head all the time she is saying the last line)).*
> *Researcher: Why is that?*
> *Barbara: I just enjoy shopping I jist [Researcher: Uhuh] I make time for my shopping (.2) If I am supposed to be somewhere else, going somewhere that night I've got to do my shopping [Researcher: You like going round the supermarket?] Uh::mm ((nods her head)).*

Barbara enjoys shopping and sees shopping through these devices on the internet as a fundamentally different way of carrying out her shopping. Shopping seems to have the following benefits for Barbara: it is enjoyable, entertaining, and satisfying.

5.4.5 Petric and Naysmith

The 'guests for dinner' scenario was chosen by Petric and Naysmith.

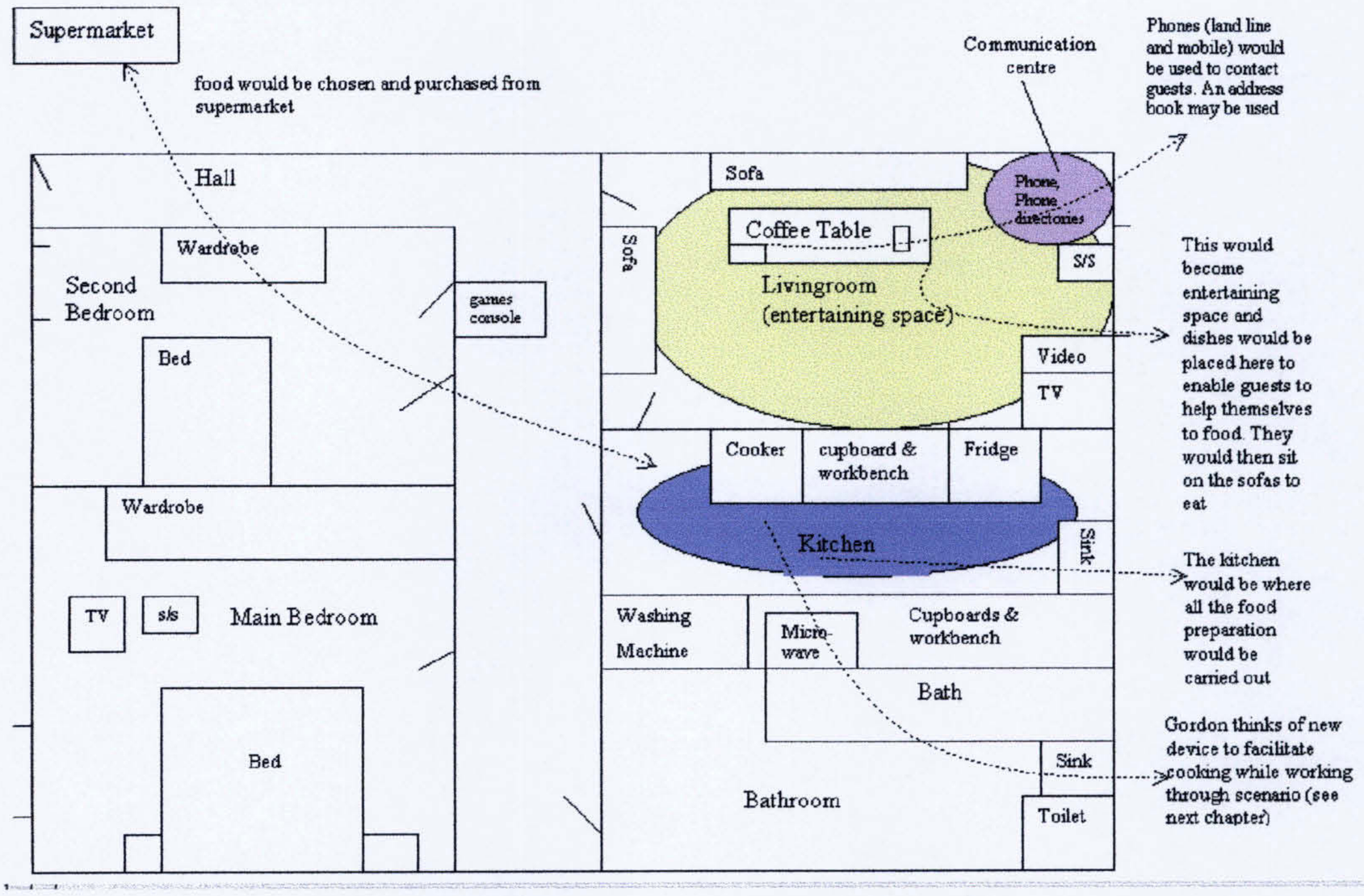


Figure 5.22: Gordon Petric and Catherine Naysmith 'Guests for Dinner Scenario'

The scenario prompted Gordon to think about how he may like to carry out the task of preparing a meal in the future:

> *Gordon: A lot of people enjoy the preparation of food (.3). It is all the different things that I have a problem with.(.) if you are cooking something quite complex it's knowing about getting all the timings ((for adding different ingredients)) and different stages all kind of synchronized in so that things are ready at the same time. It can be quite a juggling act if you are not that competent. So I don't know if it would be device or a gadget that you could get to do it, something that would help you plan step-by-step. Like get those potatoes on now. Something that would direct you and keep you right, maybe with some kind of audio sound or flashing, now add sauce, or timing it for you.*

The scenario seemed to orientate Gordon towards an idea for a new device that he wished to have.

5.5 Summary

This chapter presented data gathered from the first workshop. The aim of this workshop was to: investigate current problems and discuss future possibilities. The techniques used were: technology tour, future devices and scenarios. Each technique and the information found as a result of that technique is summarised briefly below, a fuller analysis of the findings is provided in Chapter 7.

5.5.1 Technology Tour

The technology tour technique was used to try and spark discussion and to find out ways in which people use and utilise their technology. The following issues were highlighted by the technology tour:

- Reasons for the placement of a technology and how this affected its use.
- Why some devices were unused, such as poor usability (Dreamcast games console), control issues (Atari games consoles).
- Lifecycle: issues pertaining to the lifecycle of a device such as replacement of batteries (Phone), tuning in of a television , loss of a remote, and devices that were falling apart and may have been thought to be at the end of their lifecycle were still deemed to be usable (Tape recorder and Tumble Dryer).
- Control: how people felt towards their devices or homes when they perceived a lack of control (Agnes and sockets, Dianne and CD-Player).
- Place: a device's placement gave clues to its use or non-use i.e. games console in a cupboard under washing (Dreamcast), sound system on the floor in a difficult to access corner (Reilly).
- Space: space is segregated into leisure, work, and family space in homes and technology is segregated and placed in the appropriate space. Time and use of space was also found to have an affect on a technologies use.
- Learning: non-reading of manuals (Petric and Naysmith and Smiths), no inter-family teaching (Cooks).
- Non-use or claimed non-use by some family members towards certain types of devices (Smiths).
- Cost: impact on functions used or not used (Mobile Phones), impacts on whether a device is used or not utilised because of unknown costs (Dreamcast), or not acquired (Internet access, Suttons).
- Privacy: Cook family had no passwords on their PC or games console but others (Petric and Naysmith) did.

5.5.2 Future Devices

The aim of this part of the session was to discuss with participants future possibilities. Issues highlighted by the future devices discussion:

- Utility: problems with perceived utility of the devices i.e. Emily commenting that it would take a long time to type out an e-mail on a TV remote.
- Costs: participants' wanted to know the running costs of the future devices (Gordon, Peter, Emily) but not purchase costs. Running costs were highlighted as the main barrier to acquisition and long term use or non-use of functions.

- Participants' Stories: many of the participant's stories provided clues to their attitudes towards some of the future concepts e.g. Peter's stories of finding interesting information quickly on the web and Barbara's future vision of communicating with her son via a smart fridge.
- Interaction: the different modes of possible interaction with a device were discussed and were welcomed or criticised, for example that voice interaction with a device could cause arguments (Emily Sutton).
- Need: the comments for this can be split into:
  - present need: whether or not the participants could see a 'need' for the facilities or device, resulted in a welcoming of or disinterest in a device.
  - future need: may not need at present but can see a possible future need, for example Barbara's need for an e-mail facility once her son goes to college.
  - unknown others may need: an argument was sometimes made by the participants that they could not see a need for themselves, but they could perceive of a need for someone else e.g. someone with a large family, busy life, elderly, disabled.
- Mobility: the ability to move devices without having to consider plug sockets was welcomed (Suttons).
- Promises: would the device deliver on its promises e.g. food delivery (Reilly).
- Tasks: when tasks were being taken over by the machine some of the participants questioned whether it was beneficial to carry out this task via a technological mediator rather than carrying out the task themselves. For example, food shopping: none of the participant wanted to carry out food shopping using any of these devices and food freshness warnings were dismissed as superfluous as most people have a sense of smell (Gordon).
- Privacy: the idea that the acquisition of these devices would lead to a loss of privacy (Mike Smith).
- Learning: having enough time and the ability to learn how to use new devices (Barbara and Mike).
- Utility: the utility of some of the devices was questioned for example it was felt that the screen on a mobile phone would be too small to facilitate acceptable viewing of the internet. Context and utility e.g. was it appropriate to e-mail through a microwave?
- Lack of space: was there space in their homes to place the device (Cooks).

5.5.3 Scenarios

The scenarios were used to try and discover ways in which devices are embedded in our every day lives and whether or not people could envisage new ways of carrying out certain tasks. The scenario helped to highlight the following issues and confirm the use of existing artefacts:

- illustrated the different ways participants had of gathering data in the home, for example, books, internet, CD-ROMS, newspapers, and television.
- what artefacts were used to facilitate organisation of events: recipe books, telephone, digital diaries, e-mail, cookers, and cars.
- highlighted future possibilities e.g. Simon with the possible use of web-cam to chat to multiple friends to organise a night out. Barbara through her comments on the different situations where she may use different types of phones i.e. video phone, speaker phone, and cordless phone.
- confirmed tasks that would be carried out in the organisation of an event and relative enjoyment of tasks being carried out to facilitate it e.g. shopping was seen by some of the participants as 'fun' and 'enjoyable' (Barbara, Agnes) and preparation of food was seen as enjoyable and pleasurable by some participants (Gordon and Emily).
- resulted in new design concepts, the 'guests for dinner' scenario helped one of the participants to envision a new type of device for his home.

6 Future Desires

6.1 Introduction

This chapter focuses on the second and third workshops that were carried out in the homes of five families. The participants were asked at the second workshop to envision a device for the home. They were asked to create a drawing, sketch or model of this envisionment. They were then asked to present the device and describe how the device would be used in their home, these envisionments are presented in Section 6.2.2. The participants in the third workshop were presented with the other participants design visions, they were asked to critique these visions in relation to themselves and their homes. The results of the critique session can be seen in Section 6.3.1. The participants were then asked to redesign one of the other participants design visions, these redesigns are presented in section 6.3.2

6.2 Workshop Two: Design

6.2.1 Introduction: Participants Envisioning Design

One of the older participants was hesitant about drawing his own device therefore in one instance the researcher drew the device as it was dictated to them by the participant; all the other participants managed to draw their own devices. The participants created thirteen designs in total.

6.2.2 The Designs

Universal Remote

The idea for this device emerged when Catherine was sitting in her livingroom, her gaze fell upon one of her remotes (television) and she picked it up, she then looked around the room and focused for a few seconds on each of her remotes (she has remotes for the video, sound system and television), her glance also fell on her mobile phone, which was sitting nearby. Being in her own living room and seeing the remotes and phone in context seemed to help Catherine find the idea for the universal remote concept.

> *Catherine: It is a remote control that does everything switches on your lights, fire, central heating, hot water, television, video and stereo.*

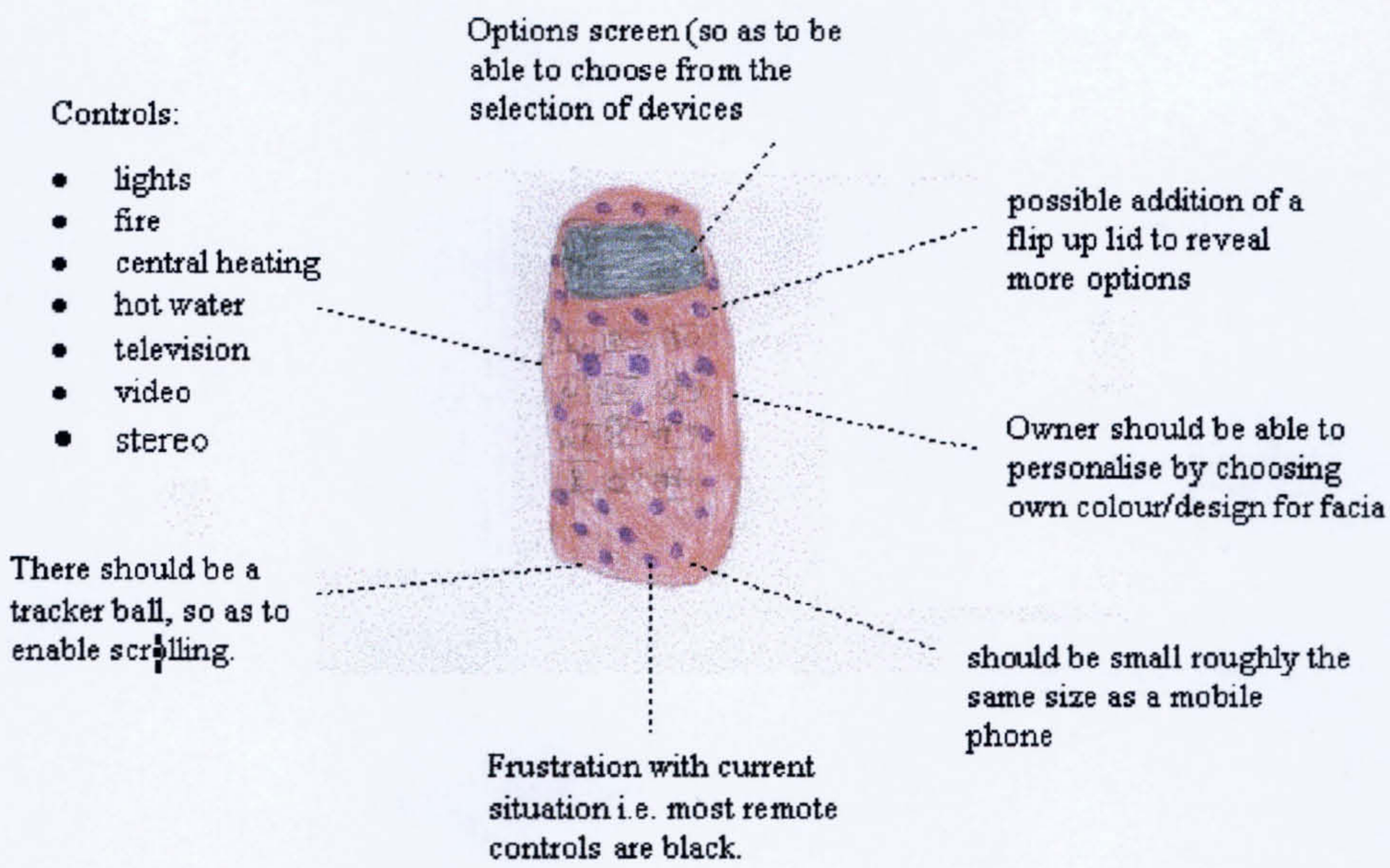


Figure 6.1: Catherine Naysmith's Universal Remote

As she explains her device, she is demonstrating how she would use it as if it existed, pointing it at the fire and television and miming how she would use it. The idea of the tracker ball and the flip-up lid (to reveal more options) gives a user more than one mode of interaction. Catherine has definite ideas about the size of the device, as well. She has also thought of the problems that may arise from controlling multiple devices, for instance, she realises that you would need multiple sets of controls and that this may become a problem due to lack of space on the remote. She has thought of two possible solutions to this possible lack of space: a scrollable option screen with a tracker ball, or a flip up lid which would reveal more, perhaps less well-used, controls. Catherine has also thought about the personalisation of the device and how the user may want to change the colour of the device. This idea was born out of a genuine frustration with the current situation i.e. that each device comes with its own remote control and remotes are generally one colour, black.

Recipe Device

Near the end of the first workshop session Gordon started designing and talking about a device he would like, which would take him through a recipe step-by-step with visual and audio cues (see Section 5.4 in Chapter 5). Gordon was asked to work on the idea for the device in-between sessions.

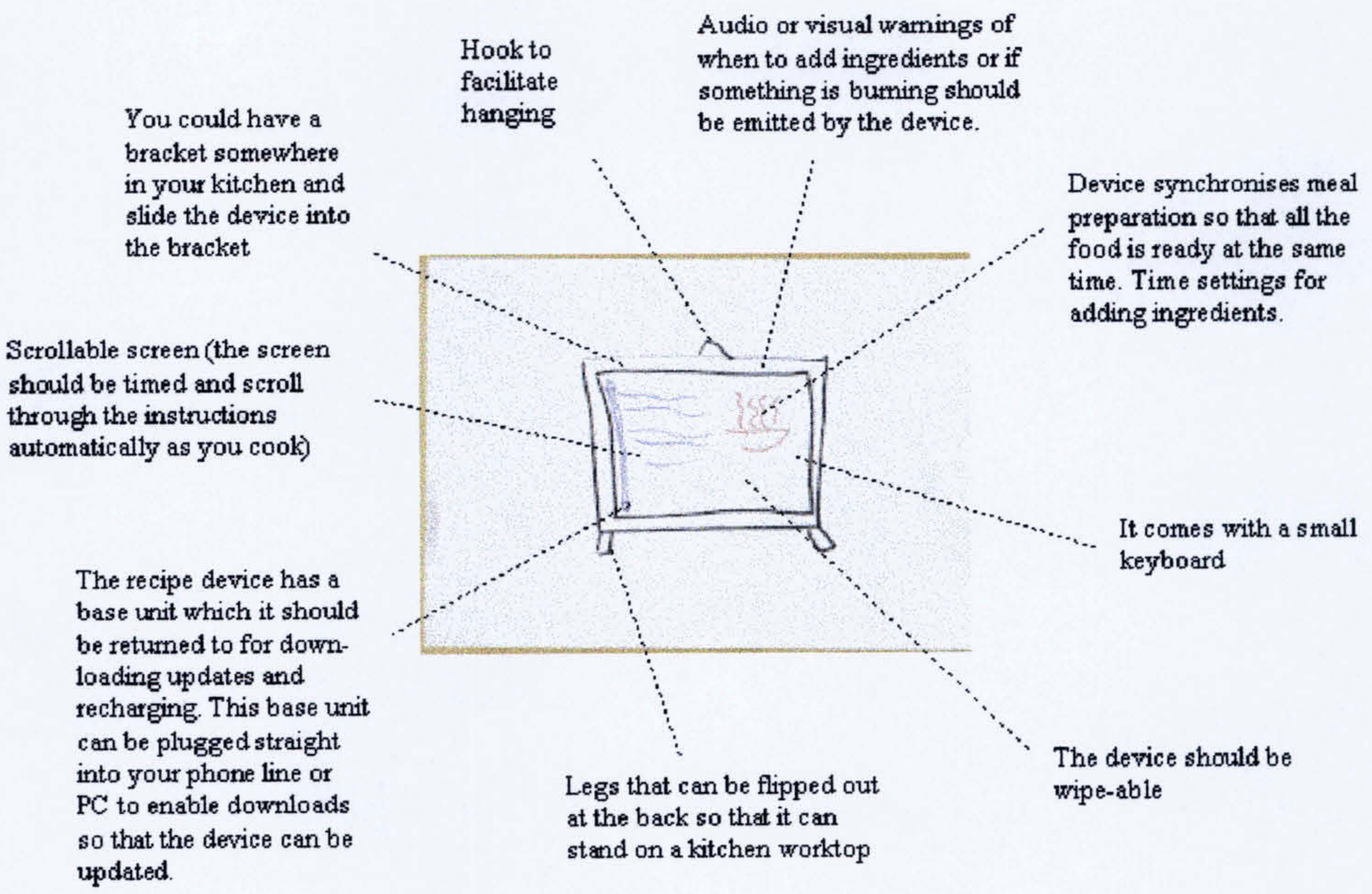


Figure 6.2: Gordon Petric's Recipe Device

Gordon mentions that the device would scroll through the recipe and would have timer information, therefore, the device would not just be displaying the recipe but would also teach you how to cook certain dishes. It is in a sense a learning tool as people would be able to learn how and when to add ingredients. As Gordon said food preparation is something he knows little about and would like to learn. Gordon has thought about the lifecycle of the device and would like to be able to update the recipes contained in the device periodically. Gordon takes me to where he thinks the device would be located in his home, the kitchen. We go to the kitchen and Gordon continued his description of how he would use the device. Once we are in the kitchen Gordon starts to think of the device in a practical way i.e. thinking about whether he would want the device at eye level, how close to the cooker, etc.

He also tries out the device in different locations in the kitchen. This prompted him to add a hook to the drawing.

At the moment people use paper-based books in the kitchen, however, a paper-based book may be unsuitable for the kitchen environment. The reason for this may be that the task of reading books, in the main, takes place either at a desk or in a chair. Books at the moment have all the affordances required for the task of reading in the above environments. However, in the kitchen the book may not be a good tool for the job e.g. the need to prop it up, or lay it down (usually on a counter, or a workbench) so that it can be read, it commonly gets splashed (so pages end up getting stuck together) and the need to change pages (just at the moment that hands could be covered in flour). The paper based recipe book we use now in the kitchen is at the very least, a flawed tool for the task. A small digital recipe book that could be wiped clean, recognise basic voice commands, issue auditory clues, and be hung easily on a cupboard or stand on its own, would, it could be claimed, improve the current situation.

Remote Home/Business Monitoring Device

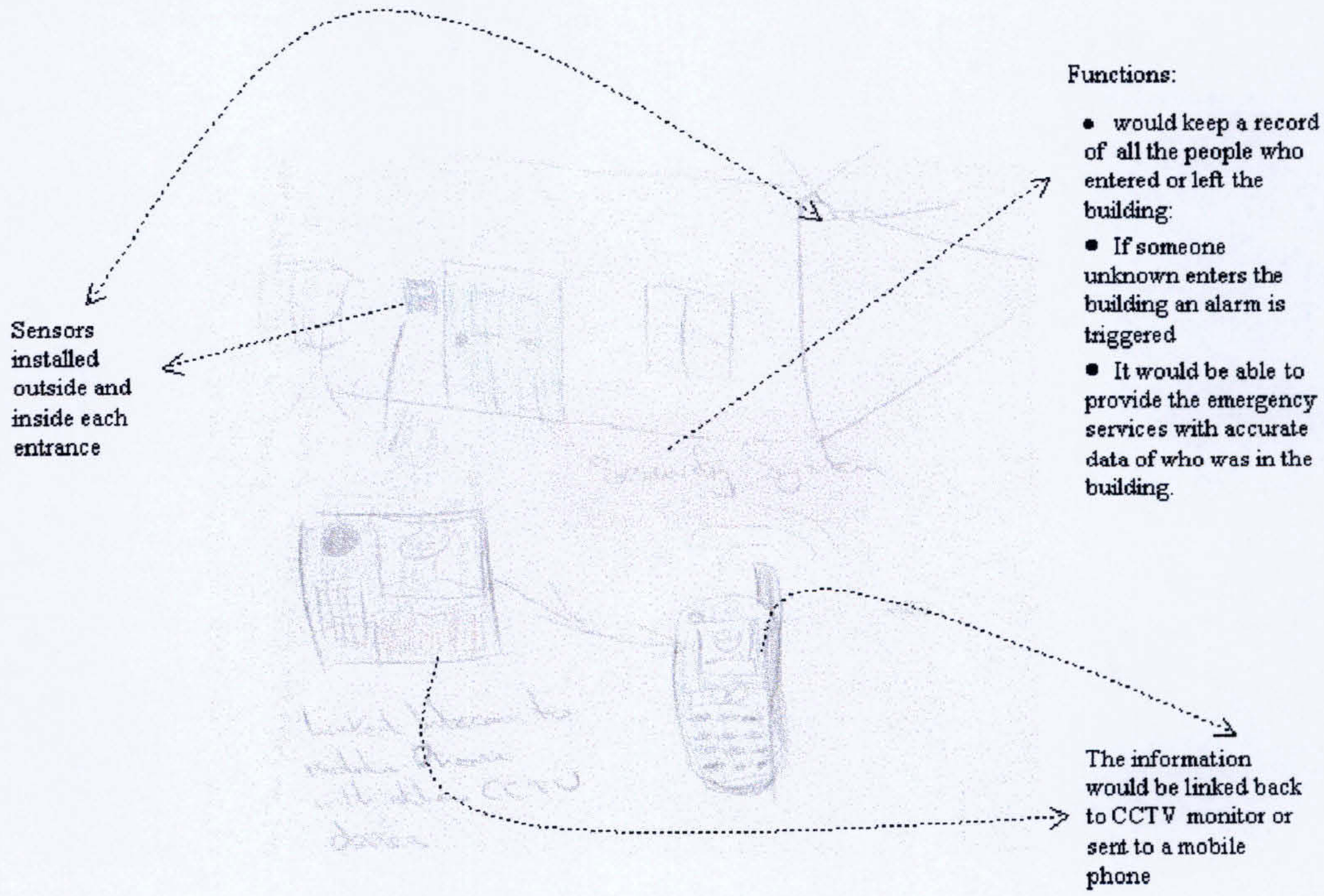


Figure 6.3: Gordon Petric's Remote Home/Business Monitoring Device

Gordon's would like his device to be used in the event of a fire alarm or an evacuation, as the system can be accessed the emergency services to let them know who, if anyone, is in the building. Gordon also wanted his device to act as a home monitoring system. Some parents do want to monitor their children when they are not there, as can be seen by some parents of young children using web cams, so as to be able to see their baby from work. The implications of this monitoring change, however, when the person being monitored is no longer a baby but nearly an adult. There are also implications for privacy, as the home is not a public space. Home monitoring may become more prevalent in homes in the future as it was mentioned by four of the participants in this study.

Home warning device

This is a panel that would hang on your wall and would have a family picture, painting, or drawing displayed when not in use. Peter felt very strongly that he did not want a screen taking up space and dominating the room, he wanted something pleasurable to look at and that would merge into the background of the room.

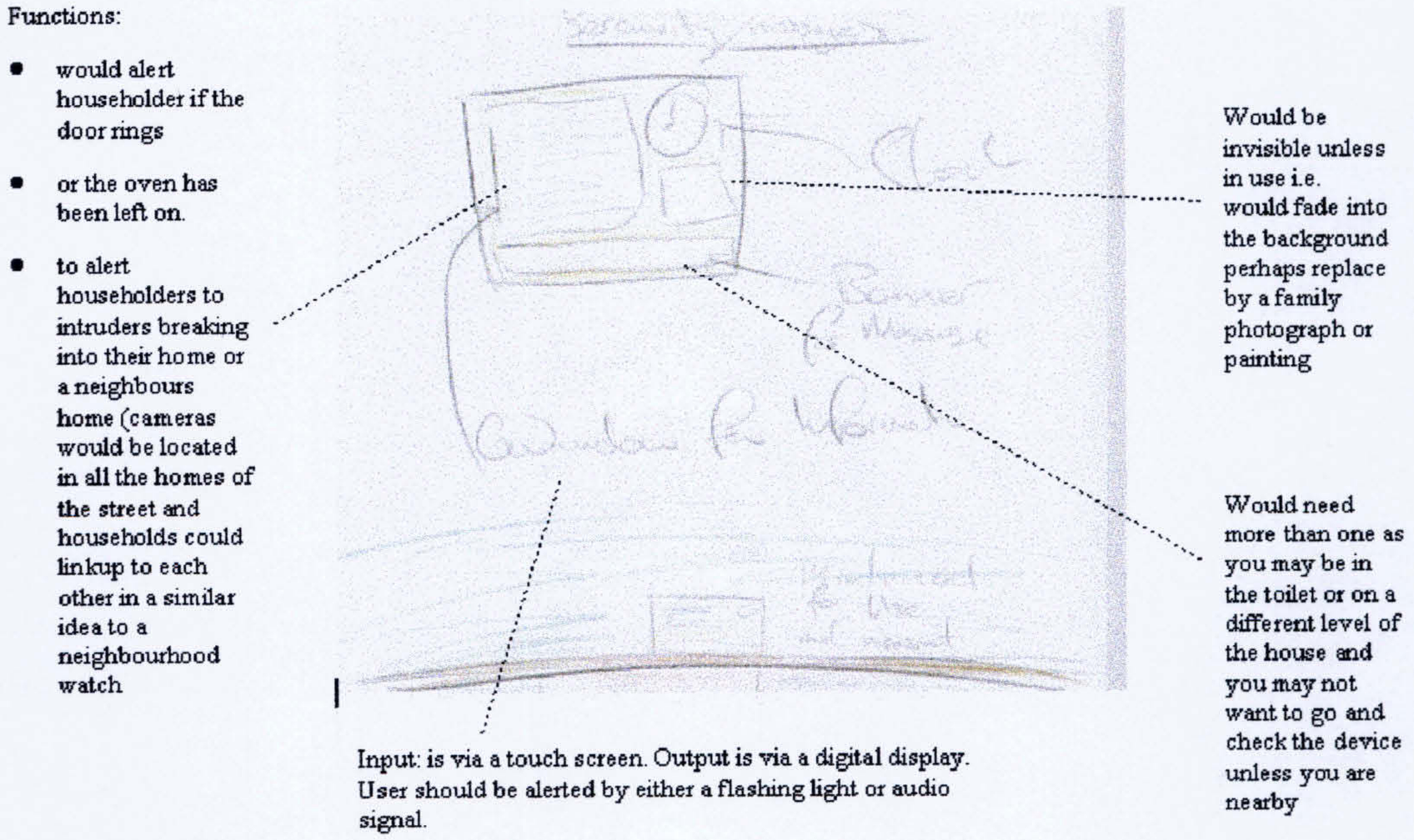


Figure 6.4: Peter Sutton's Home Warning Device

Placement of the device is important to Peter, the device needs to be situated somewhere Peter can easily see it or be easily moved. Peter also remarked that if other houses in his street were wired up to this system, they could have a communal warning system if anyone's house was broken into

It is interesting that Peter only wants the device to be visible when it is required and disappear into the background when not in use. The fact that a senior citizen designed a device, which would help him as he grows more infirm is of interest, as many researchers at the moment are looking at building 'smart homes' and trying to understand what senior citizens would want from this type of home. This design shows that it would perhaps be of benefit to researchers and to senior citizens, if the designer/researchers were to involve senior citizens in the process, and ask them how they want to be supported by technology in the home.

Home Controlling Device

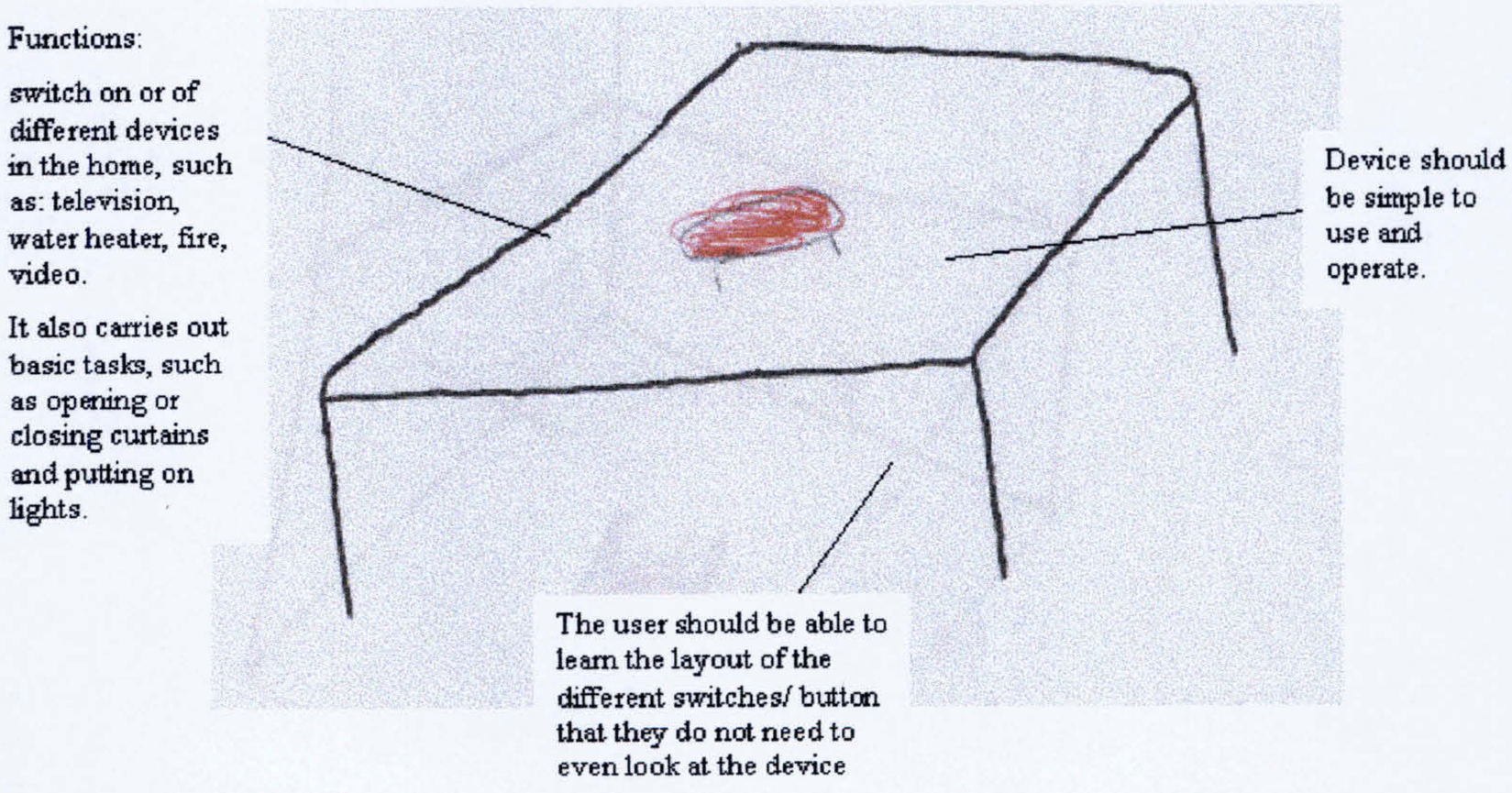


Figure 6.5: Emily Sutton's Home Controlling Device

Emily did not seem as animated and talkative as she was in the first session. She seemed rather tired, and was, unbeknownst to me, unwell at the time, therefore, I do not feel this design accurately represent her ideas or possible ideas for a device in the home. However, I felt that what ideas she did have, should be reported.

Emily's device is a home device similar to Catherine's remote. Emily would like the device to carry out household tasks such as drawing the curtains. She would like the device to be a panel on the wall or a remote control. She did not want the device to be too complicated, as can be seen from the drawing above. Emily envisaged this device carrying out quite a few basic tasks in the home. Emily commented that her device should be easy to learn, and that the user, over time, would be able, by using touch alone, know what each button was for.

Amazing Pet

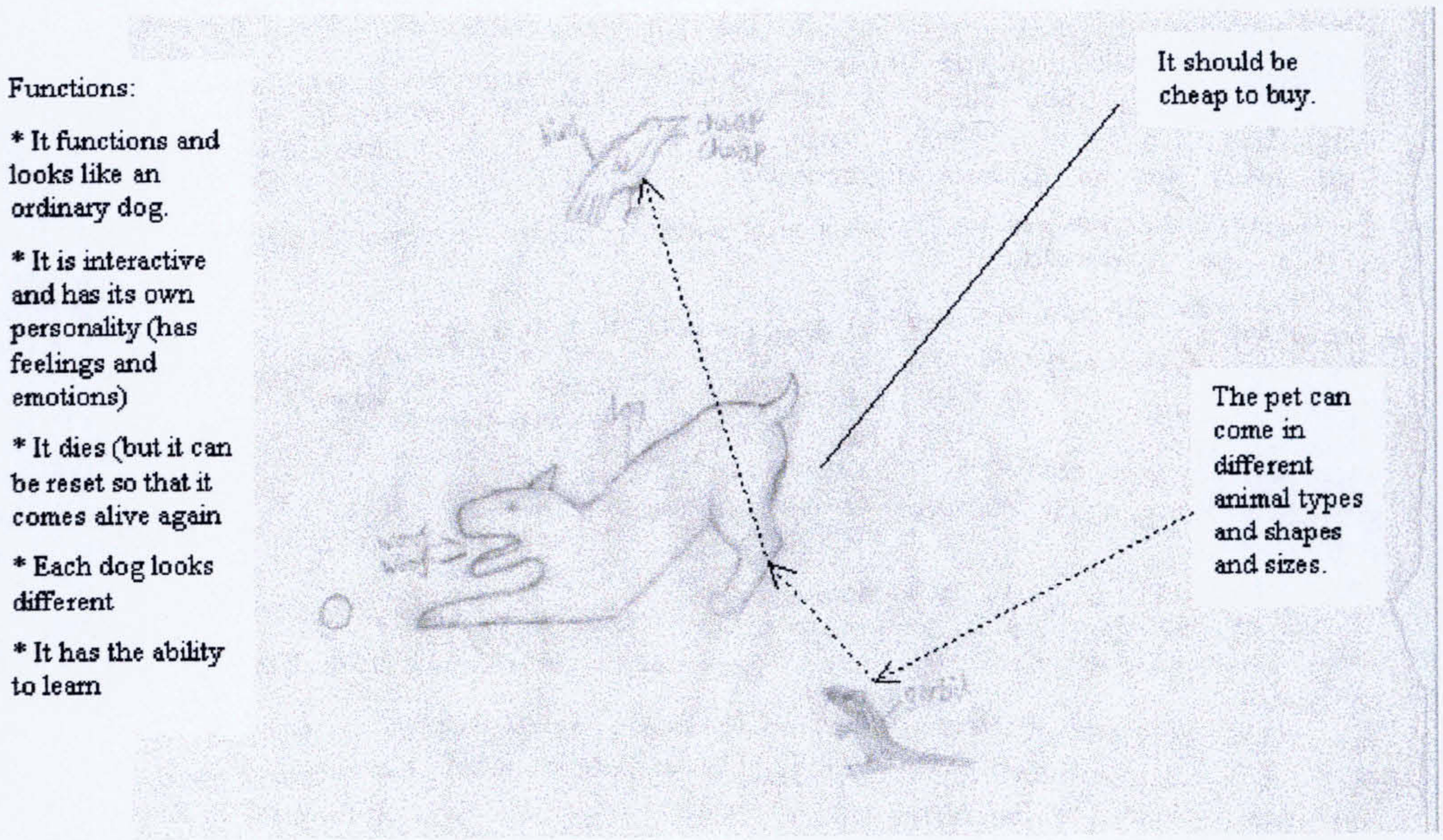


Figure 6.6: Dianne Cook's Amazing Pet

This design has some features that could be implemented, but others, are clearly impossible at the present time. However, the design does give some clues towards what Dianne would like in a device, for example, she does not think devices should be expensive, break, get scratched/damaged, she wants them to last a long time – a 'lifetime'. One of her requirements, in a quite futuristic pet, is cost, therefore when we are designing with children we should not think that they are always unaware of the cost issues involved in the acquisition of a new technology. Dianne wanted quite a personalised pet, in that, she wanted all the pets to look different and have their own personality, which could be reset by their owners.

Robot Friend

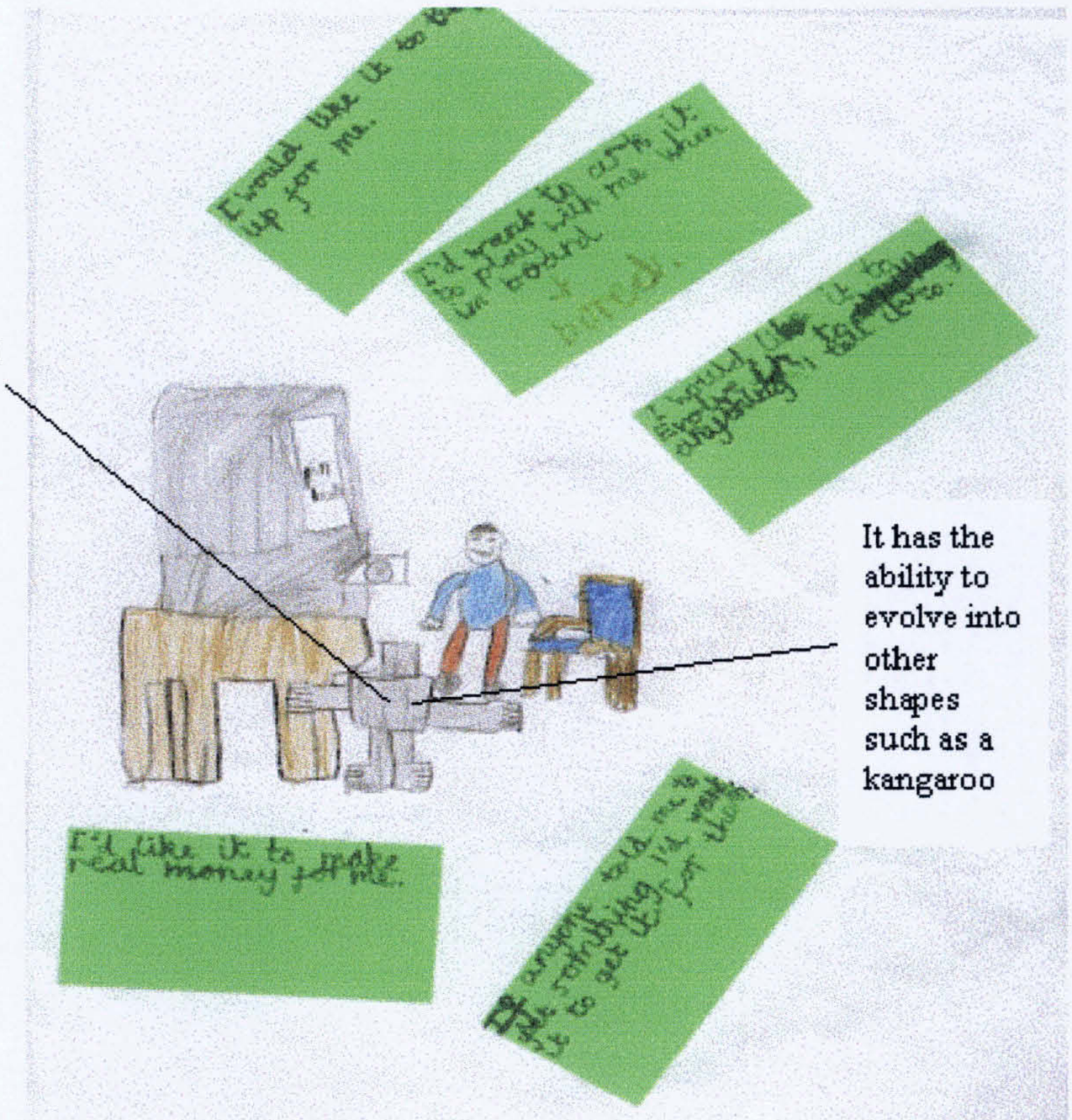


Figure 6.7: Tarquin Cook's Robot Friend

Tarquin's main requirements revolved around home maintenance and finance e.g. he mentioned cost and the cleaning of his room, when talking about his robot. He even puts Post-its on the device in the weeks in-between workshops to emphasise these points e.g. he wanted the money it provided to be 'real' money. In case it should be assumed that he meant play money. Tarquin is not so much wanting a friend, as much as a slave or labour-saving device.

Automatic Lawnmower

Robert Cook has designed an automatic lawnmower. The lawnmower would be programmed with the layout of the user's lawn:

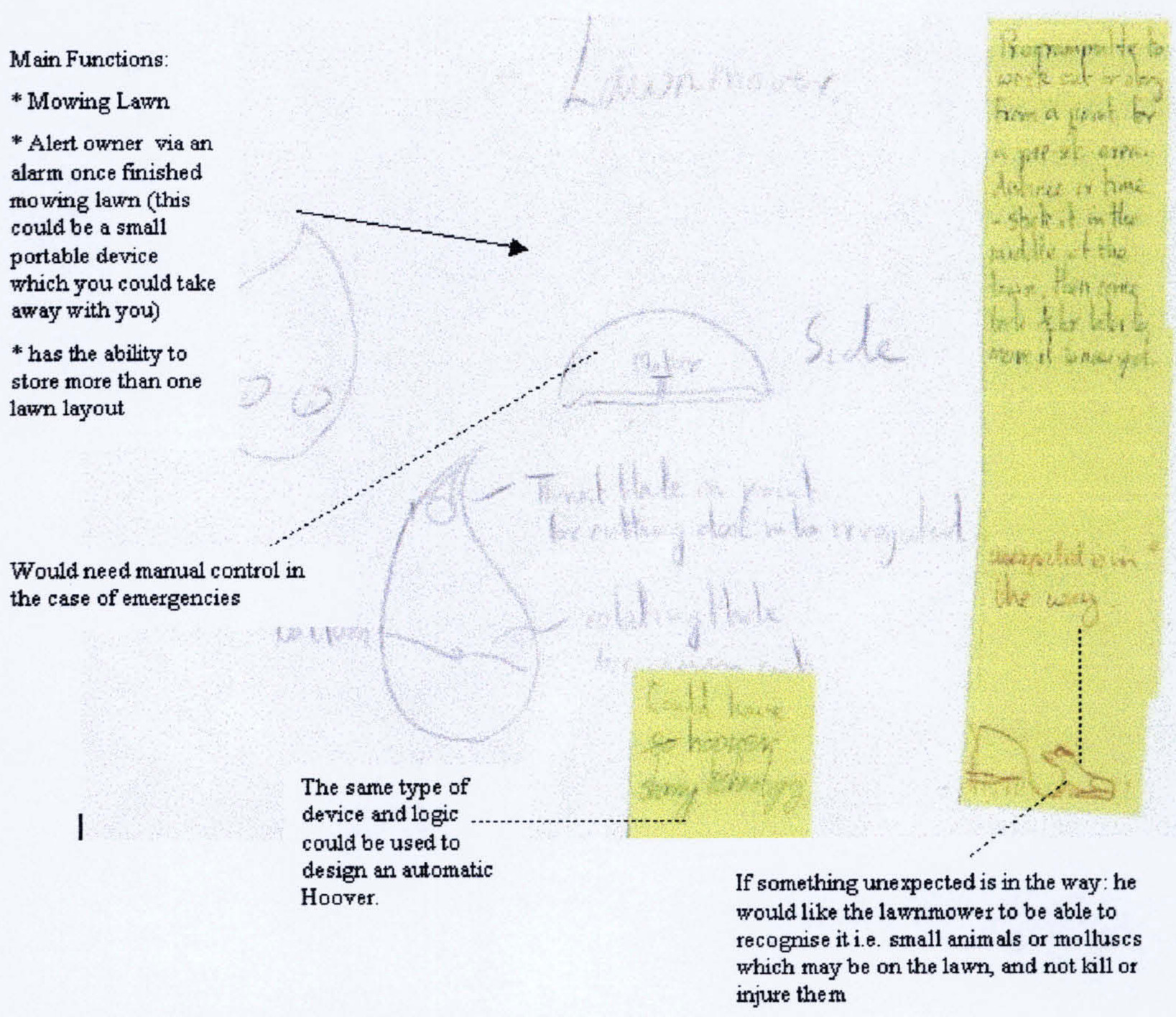


Figure 6.8: Robert Cook's Automatic Lawnmower

Robert has thought about the lifecycle of the lawn mower and has anticipated that it is more than likely that people's gardens will change over time. Robert wanted to leave the device to carry out the task of mowing the lawn and to alert him remotely once the task had been completed. He also wanted it to have some kind of safety device so that it would not damage or injure something on the lawn. He mentions that the user should be able to override the automatic controls.

Robert has thought of the lifecycle of the device and some practical problems associated with this. The lawnmower was an interesting choice for Robert to make as one of his few household tasks is to mow the lawn, therefore, perhaps this was a task he wanted to be taken over by a device.

Robot Servant

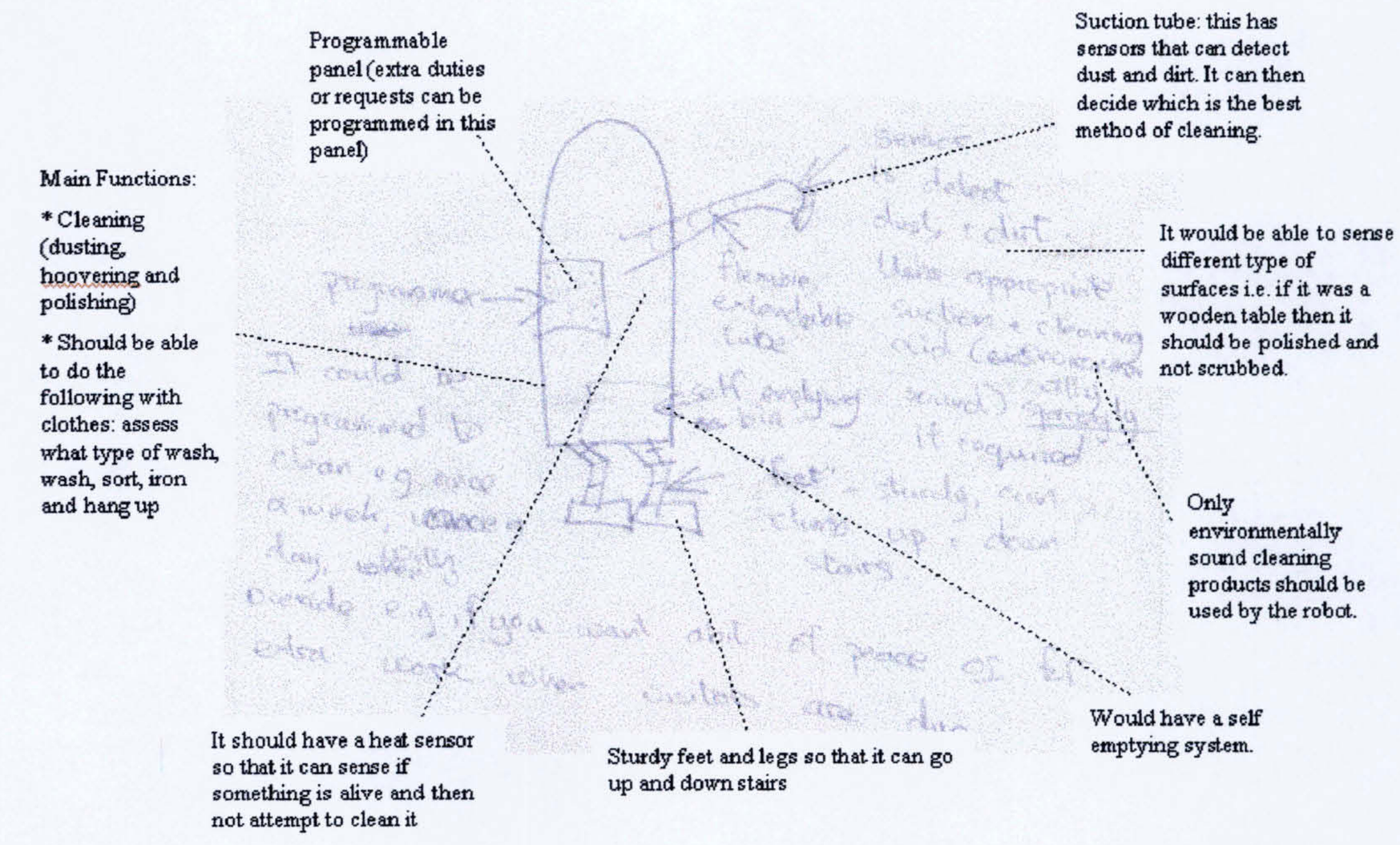


Figure 6.9: Sue Cook's Robot Servant

Sue Cook designed a cleaning robot that would clean the house. The robot would be able to go anywhere in the house and clean. Sue has thought of how the device could be used in practice (see her comments about only using environmentally friendly products). She has also thought of the different design issues implicit in her design such as how the robot would be able to climb stairs and know when to empty itself.

Home Infotainment Centre

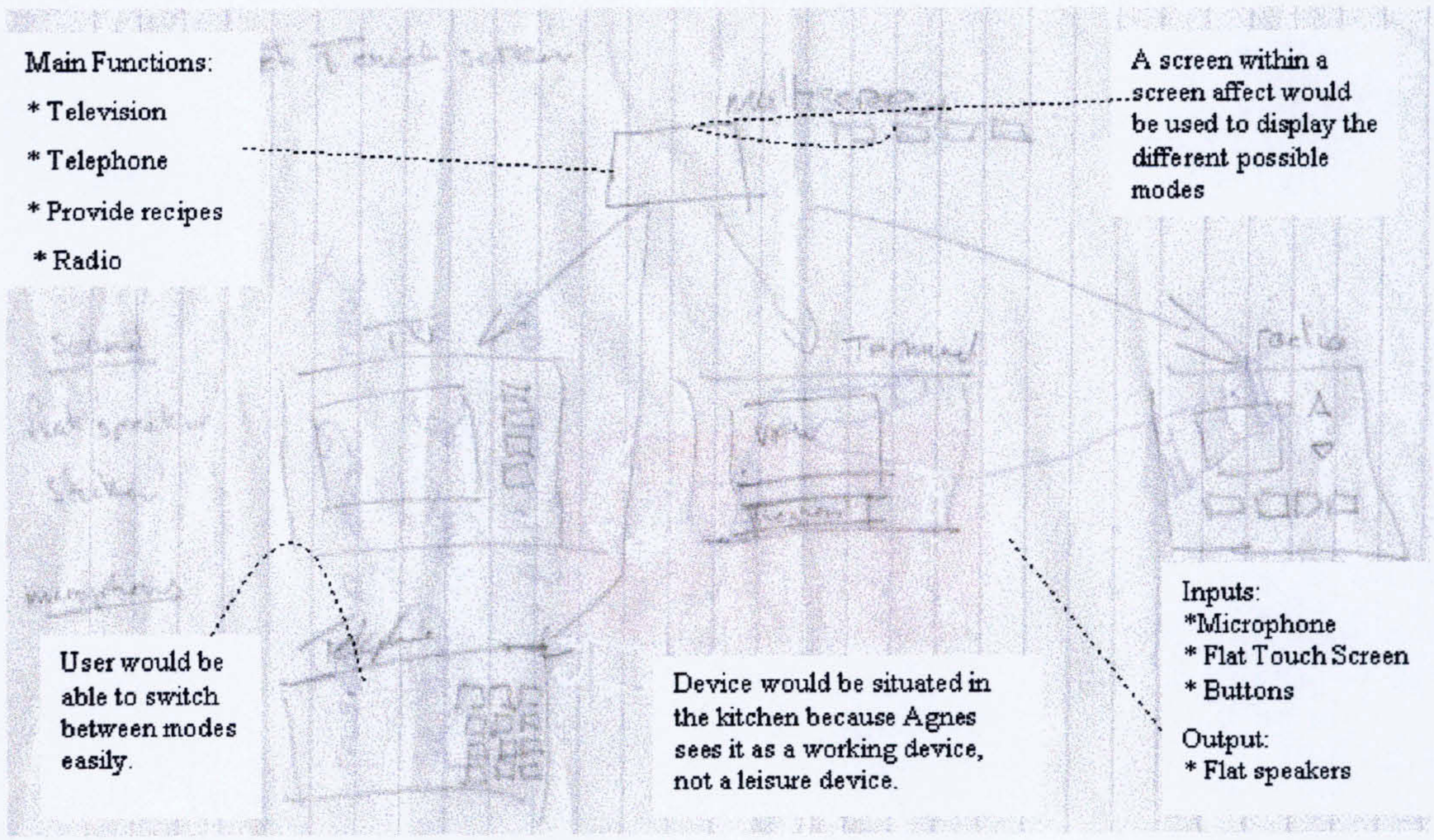
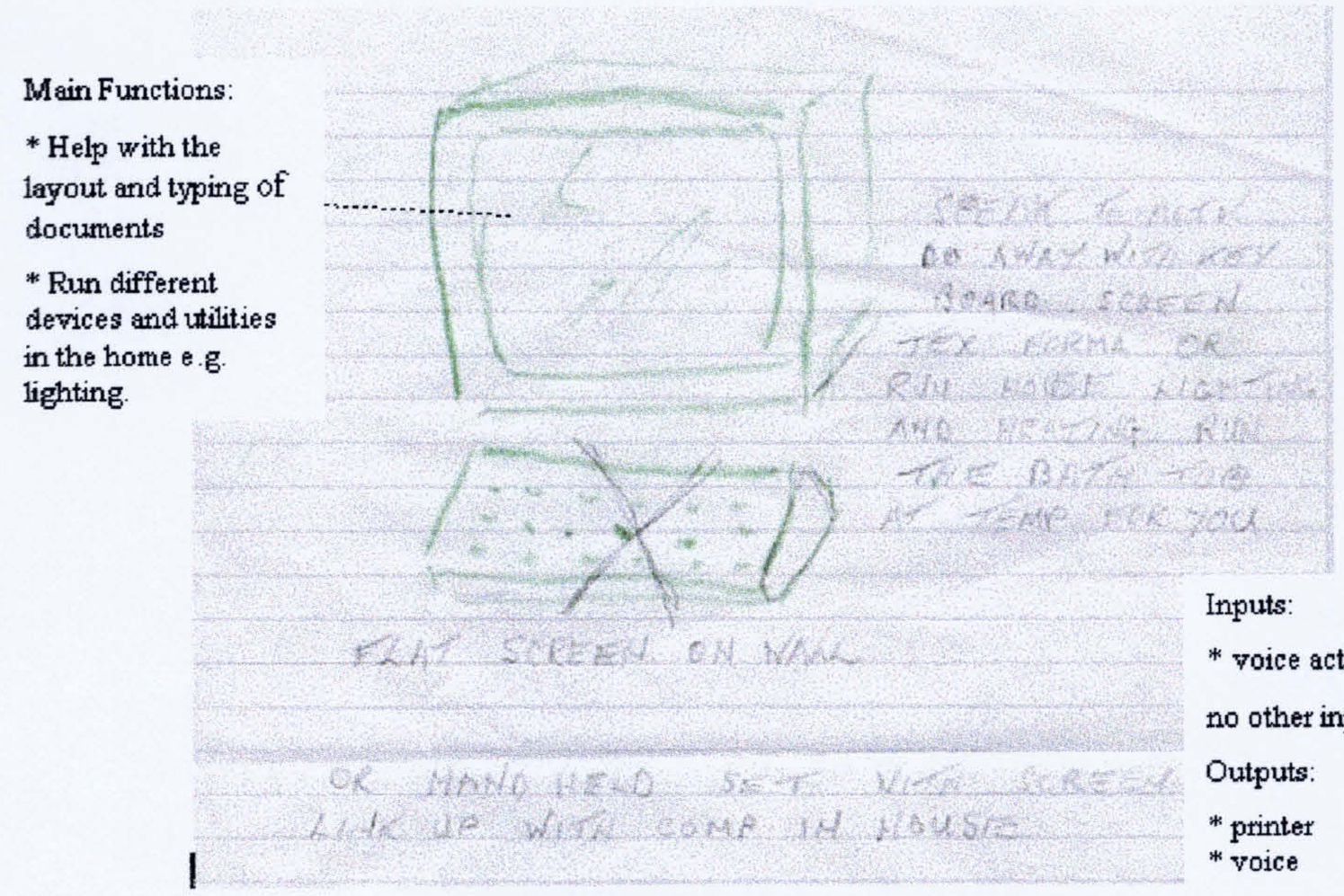


Figure 6.10: Agnes Reilly's Home Infotainment Centre

Agnes, when thinking about her device, remarked that she would want to be able to input information into the device rather than the manufacturer making that decision. She has decided that the kitchen would be the best place as other places in her home would be inappropriate or too small. She states that the sitting-room is for leisure and the kitchen is for work, and that the hallway is too small, and that this is why she has decided to situate her new device in the kitchen. She wants the device to be in a fixed position near plug sockets, and away from moisture or excessive heat. Agnes is thinking of the device as if it was actually going to sit in the kitchen at some point. From Agnes's few remarks it was clear that she has definite views on what constitutes workspace in her home and what is leisure space, and is unhappy if an attempt is made to mix the two spaces.

Voice Activated Home Controller



Main Functions:

* Help with the layout and typing of documents

* Run different devices and utilities in the home e.g. lighting.

Inputs:

* voice activated

no other inputs

Outputs:

* printer
* voice

Hand held portable device could be detached from unit and taken outside the home which would link up with device inside the home

Figure 6.11: Mike Smith's Voice Activated Home Controller

Mike Smith would like a device which would be situated on the wall above his current workspace. Mike wanted the device to act as a teacher, for example, he would like it to help him set out Word documents, make suggestions about how to fix mistakes in his documents, and so on. He wanted the device to be voice-activated. He further wanted the device to talk to him and give him advice on the correct layout of documents. In his drawing he has crossed out the keyboard, this is because he does not want the device to have any peripherals. His first descriptions give the impression that he thinks of the device as primarily a tool to assist with his work, however, he starts to talk about how the device could run various utilities and devices in his home. His choice of input modes could be problematic in real life as the reliance on voice-activation and touch-screen could create problems as voice- activation software is notoriously unreliable and touch screens can quickly become smudged.

Home Larder and Recipe Device

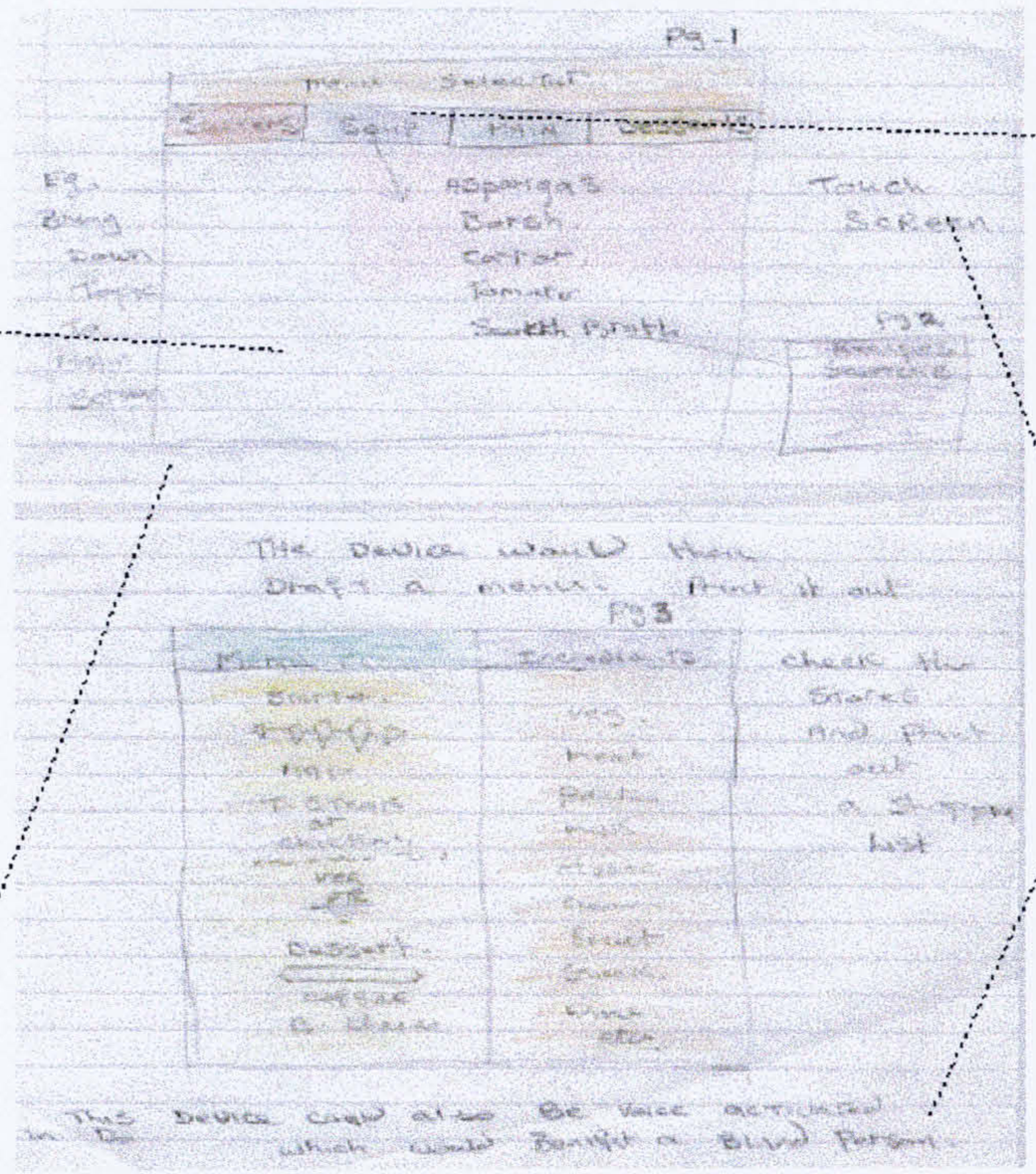


Figure 6.12: Barbara Smith's Home Larder and Recipe Device

Barbara, along with the majority of the other participants, demonstrated her design in situ and showed how she would use it by gestures and mime. To further explain her design Barbara gestured towards the cupboards and fridge, when describing how she carries out a manual check of her foodstuffs at the moment and then demonstrated with the new device how this device will mean that she doesn't have to carry out this manual check anymore. The device interface is divided into colour categories, for instance, soup recipes are blue. She remarked that this will help her and other people if they are in a hurry. She commented that the concept of a quick reference may benefit people with disabilities, though she did not elaborate on how. Some of the participants mentioned usefulness to other social groups i.e. senior citizens, disabled people and so on. Perhaps this is something that people say if they feel they need to justify having a device carry out a task on their behalf.

Entertainment Centre

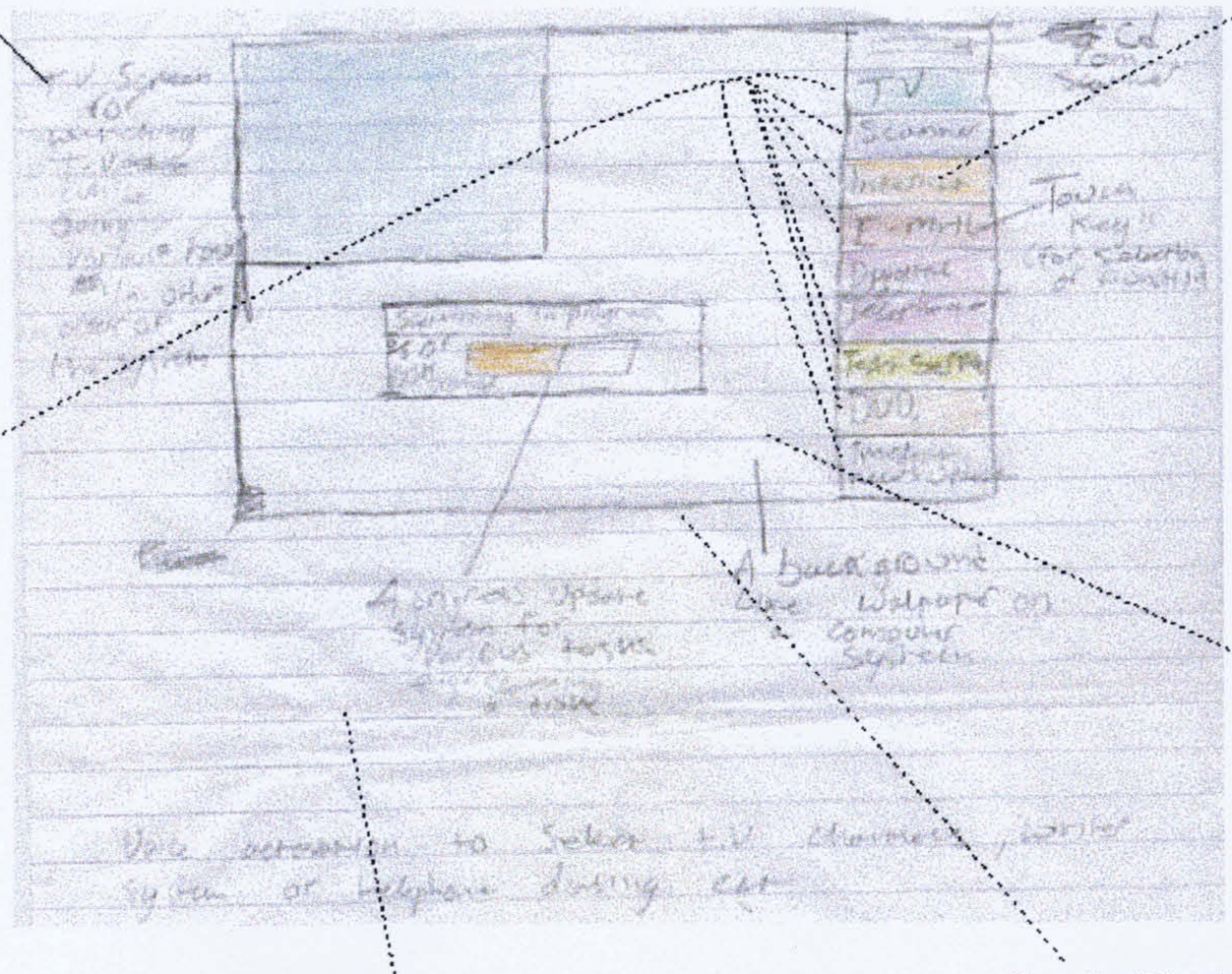


Figure 6.13: Simon Smith's Entertainment Centre

Simon did not seem to have thought through how his device would be used in real-life, this is in sharp contrast to the designs of most of the other participants who had many thoughts about how their device would be used. Simon was quite monosyllabic, and did not express himself or his ideas particularly well. He also picked out the latest must haves, such as a DVD-Player. His choice of placement was consistent with the layout of his room, as he wished to have the device placed in the position currently inhabited by his PC. He would also like the device to be in his favourite colours. Simon has quite a small room and it could be claimed that his concept device has more to do with the physical limitations of his room rather than the technology.

6.3 Workshop Three: Critique and Re-design

In this session the participants were asked to critique the designs of the other participants. They were then asked to use these criticisms as a way of improving upon the original design.

6.3.1 Critique

In the critique stage the researcher introduced and explained the other participants' designs to the different family groups in their homes. Each design envisionment was passed around and the main concepts were explained. The participants were encouraged to comment on the designs. The purpose of the critique was to learn about what the other families thought of each others designs and to let them see how other families had designed differently from them.

Universal Remote

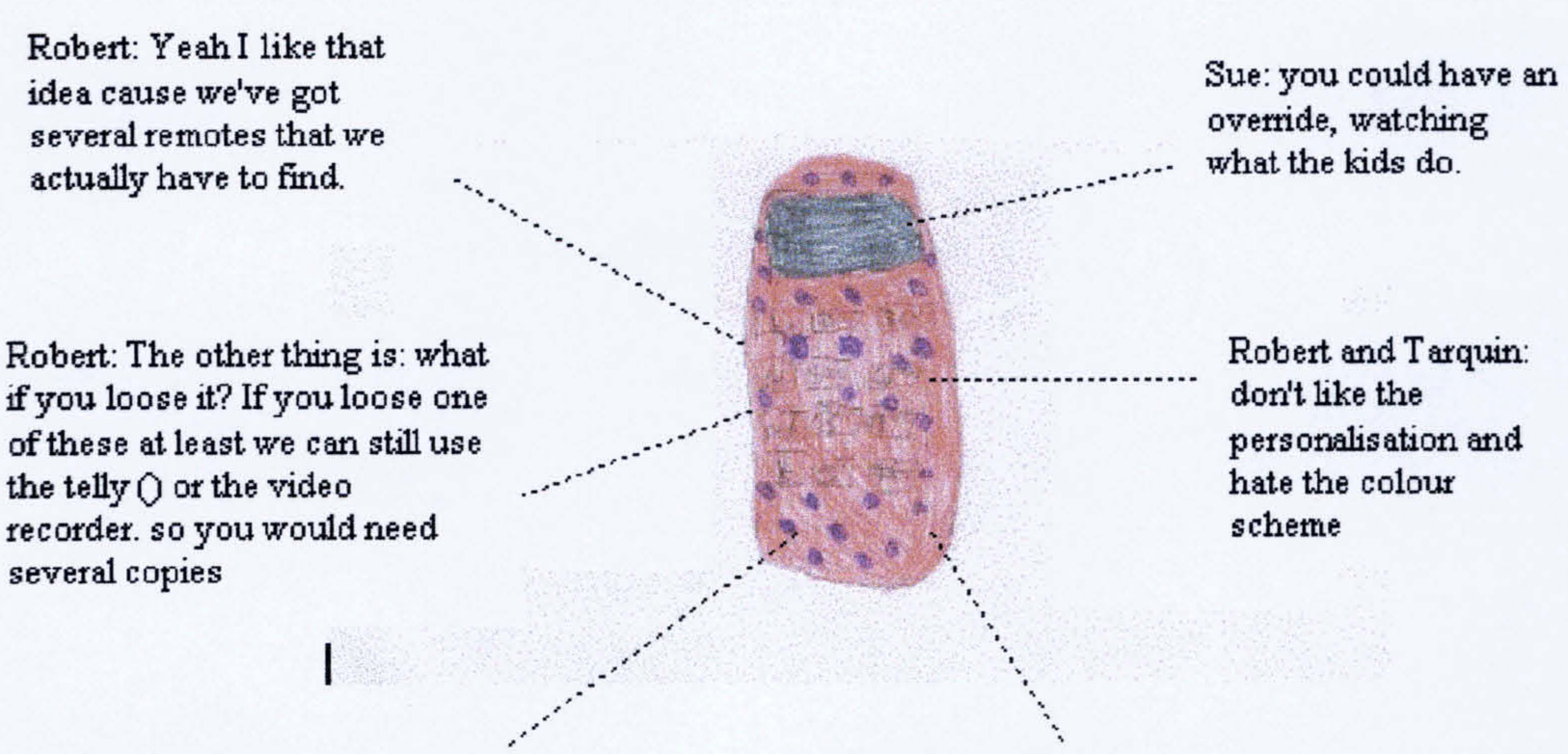


Figure 6.14: Critique of Universal Remote

Sue really embraces the idea of personalisation. Even going as far as to suggest that the device could be colour coordinated to match each room.

Robert can see how having such a device would help him and the rest of the family as they are always trying to find various remotes. Robert points out that there could be a problem if you lost the universal remote, as you would not be able to work any of your devices. However, he resolves this issue himself by saying that you could have several copies of the device. Certainly the remote is in a sense inflexible in that you may loose the ability to work your devices if you loose the remote or it is broken. It is clear from this that Robert is thinking through the lifecycle of the remote and problems that may occur. The issue of placement and where people want to locate devices can be affected by the loss of a remote. Also many devices do not offer the full functionality of the device except through the remote. The idea of the user being able to personalise the remote seems to have been welcomed by the mother of the family but not the father or son. Both the father and the son have negative feelings towards the remote, not related to the concept but related to the colour.

Sue comments that the parents should be able to override any of the children's remotes. Robert (father) simply wants his remote to have priority over everyone else's.

Home/Business Security Device

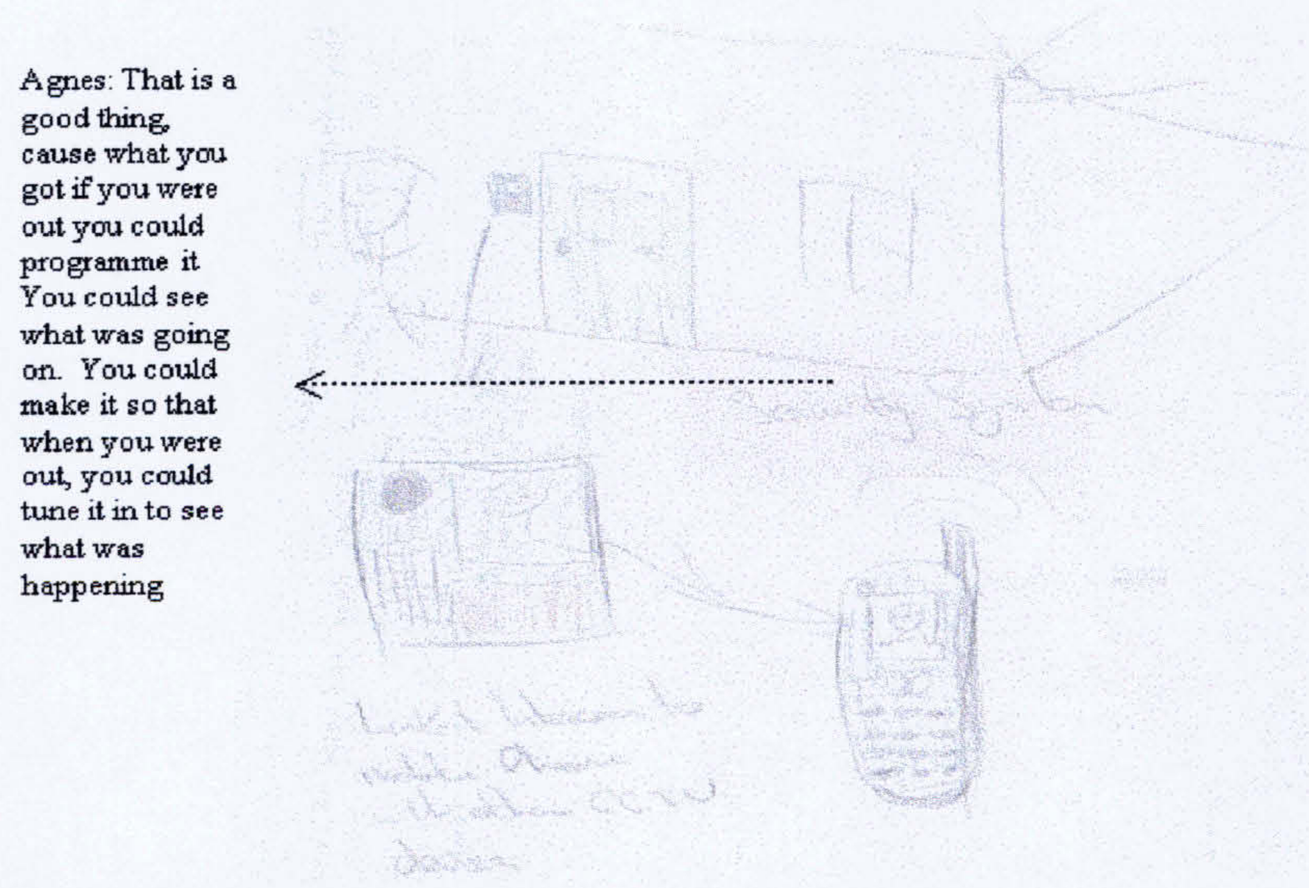


Figure 6.15: Critique of Remote Home/Business Monitoring Device

Agnes thought that Gordon's device was a good idea. She in fact chose to redesign this particular device. She liked the idea that she would be able to know what was going on in her home when she was not present. The attraction with this device for Agnes was that it is not an alarm in the traditional sense i.e. loud screeching noise, but an alarm that alerts you remotely to the fact that someone is in your home.

Home warning device

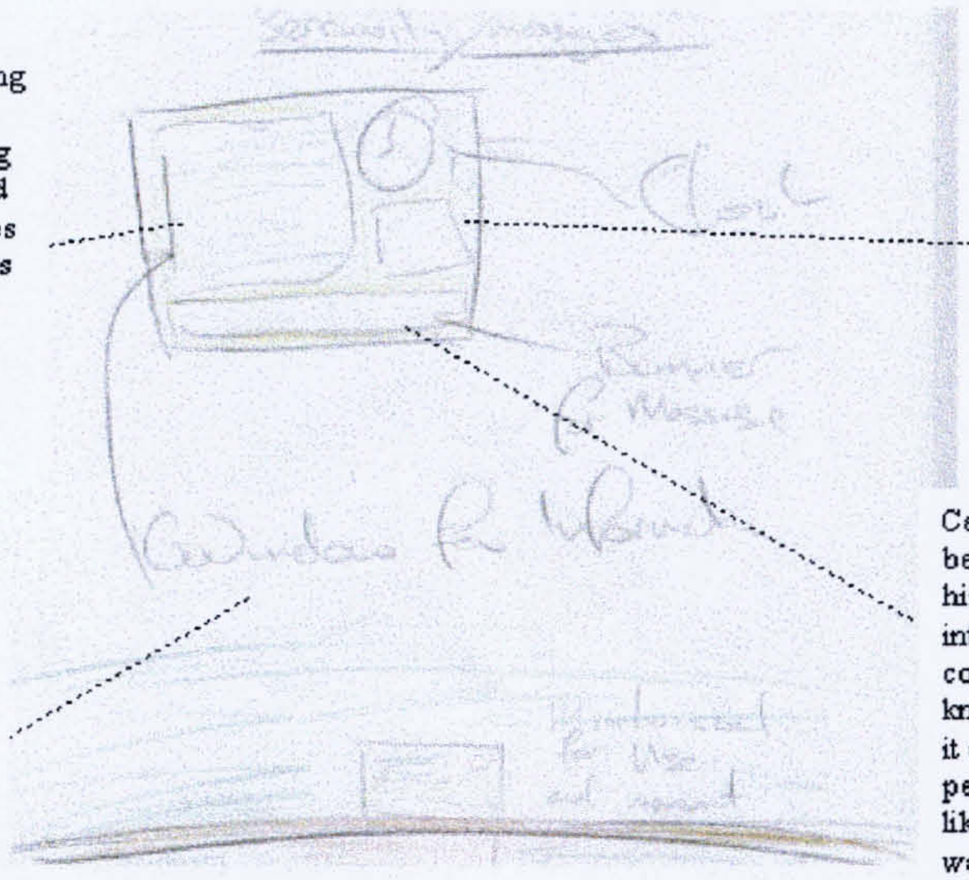


Figure 6.16: Critique of Home warning device

Sue and Robert are interested in the alarm function of the device and how it would work exactly e.g. how long would the alarm sound for? Would the person have to press it to turn it off? Robert mentions that this could be a problem if the person or persons were out. Catherine and Gordon are also interested in exploring the idea of security and Peter's device. Gordon and Catherine think that the idea of using the security device as a type of neighbourhood watch idea is something that they think has lots of potential problems. From the comments on Figure 6.16, it would seem that the participants could not see the added benefit of having a device such as this. They focused exclusively on the security, this could be due to their place in the lifecycle and the location of their houses.

Also, even though Peter's device had many functions, other than security, the security function was the one discussed exclusively by the participants.

Amazing Pet

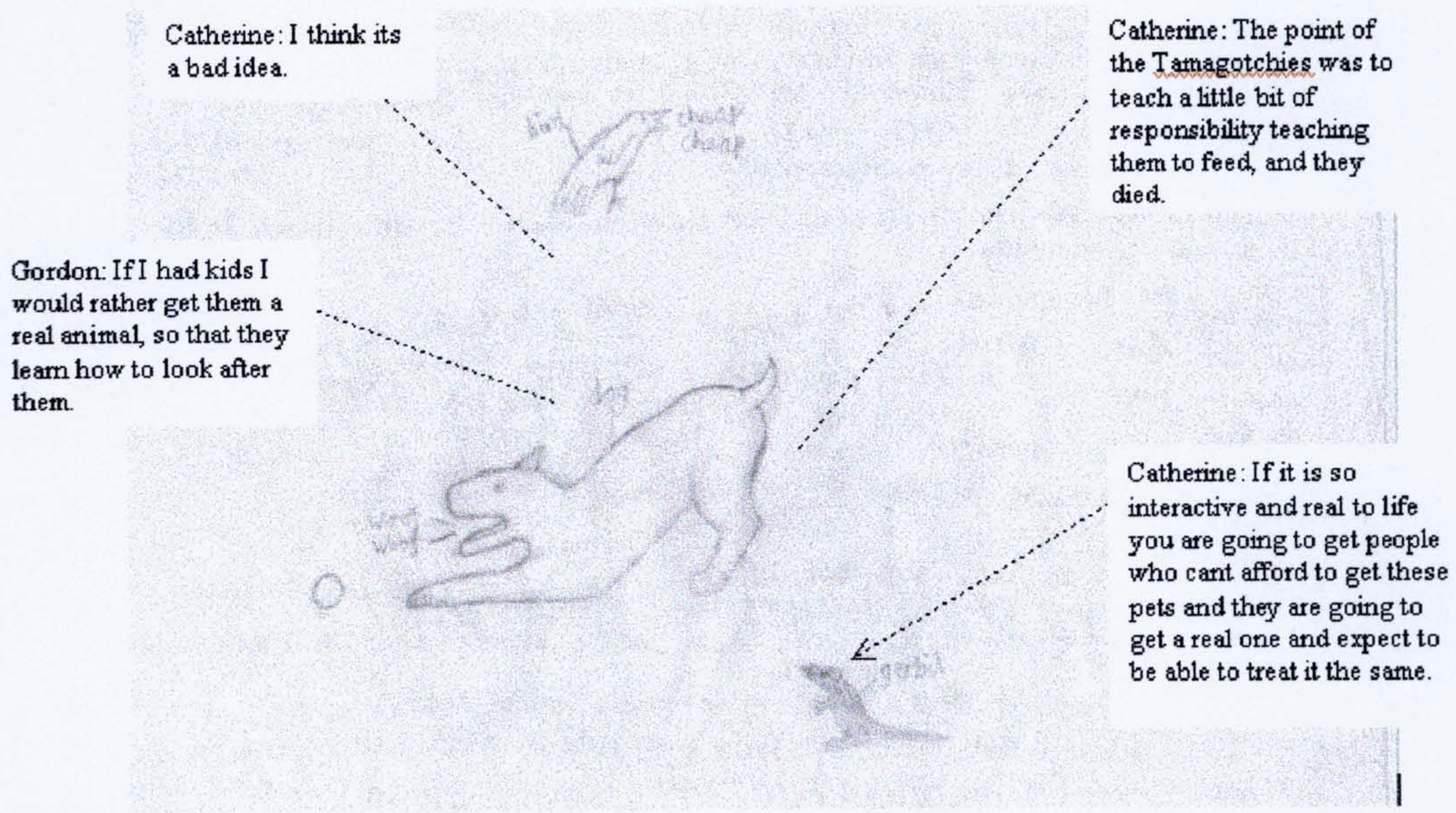


Figure 6.17: Critique of Amazing Pet

Catherine and Gordon comment that Dianne's idea for a robotic pet could be bad for children's development. By eliminating the tasks associated with pets, children may not appreciate the hard work involved with real animals. This type of design could lead to real issues of how children act with 'live' as apposed to 'robotic' pets.

Robot Friend

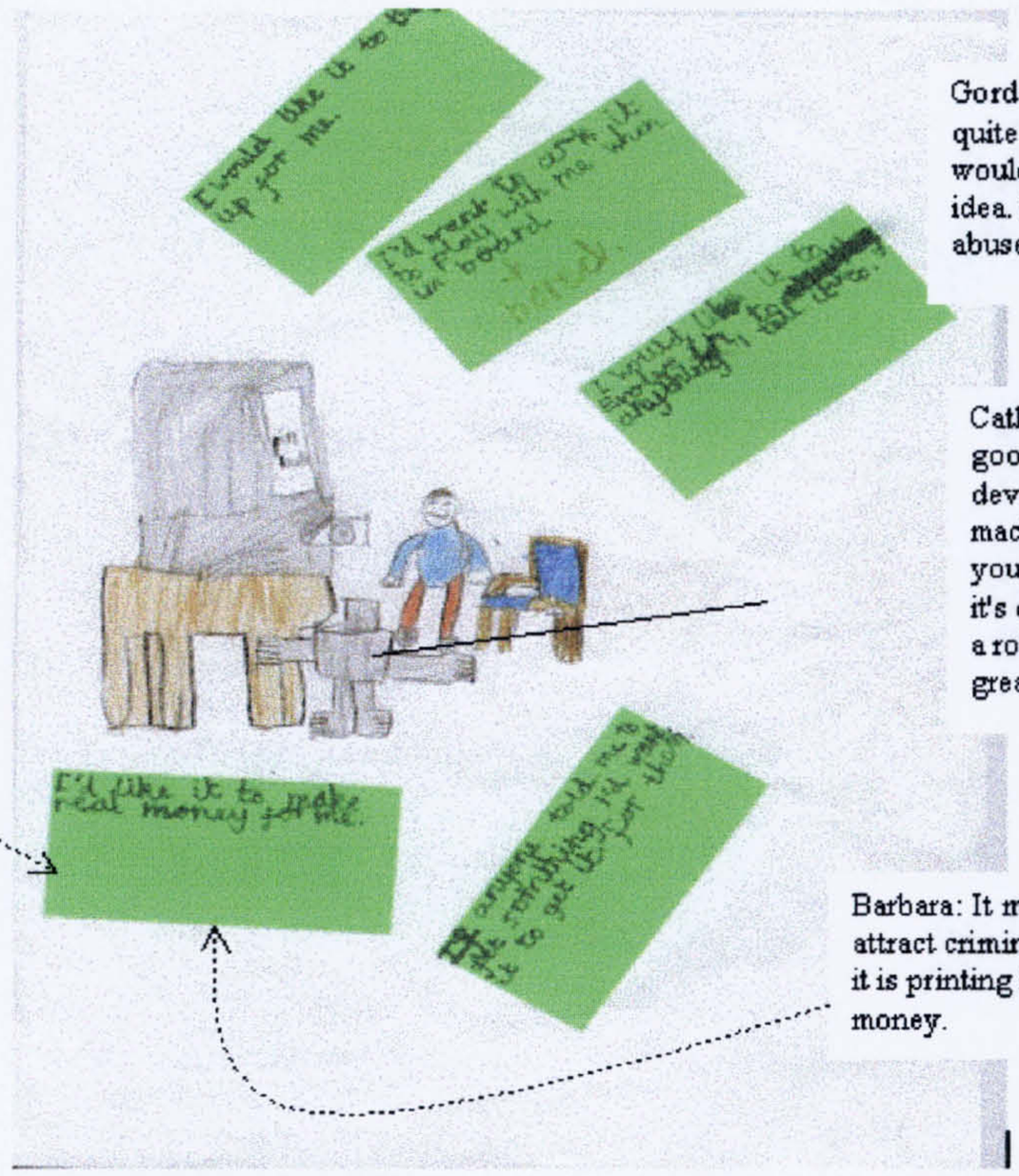


Figure 6.18: Critique of Robot Friend

This particular design evoked strong comments from the adults. Some of them felt that this type of device could be abused by adults for their own purposes. For example, Gordon thought that the device might be appropriated by people with certain fetishes. Gordon and Catherine made comments about child development and the affect such a device could have on a child if they possessed such as device:

The Smiths comments centred around one of the device's functions, its ability to make money.

Gordon, Catherine and the Smiths have obviously looked at this device in a very adult way and the possible implications of having a robot which would do anything for you, and have seen drawbacks to this in real life. These possible abuses were something the seven-year-old designer did not envisage.

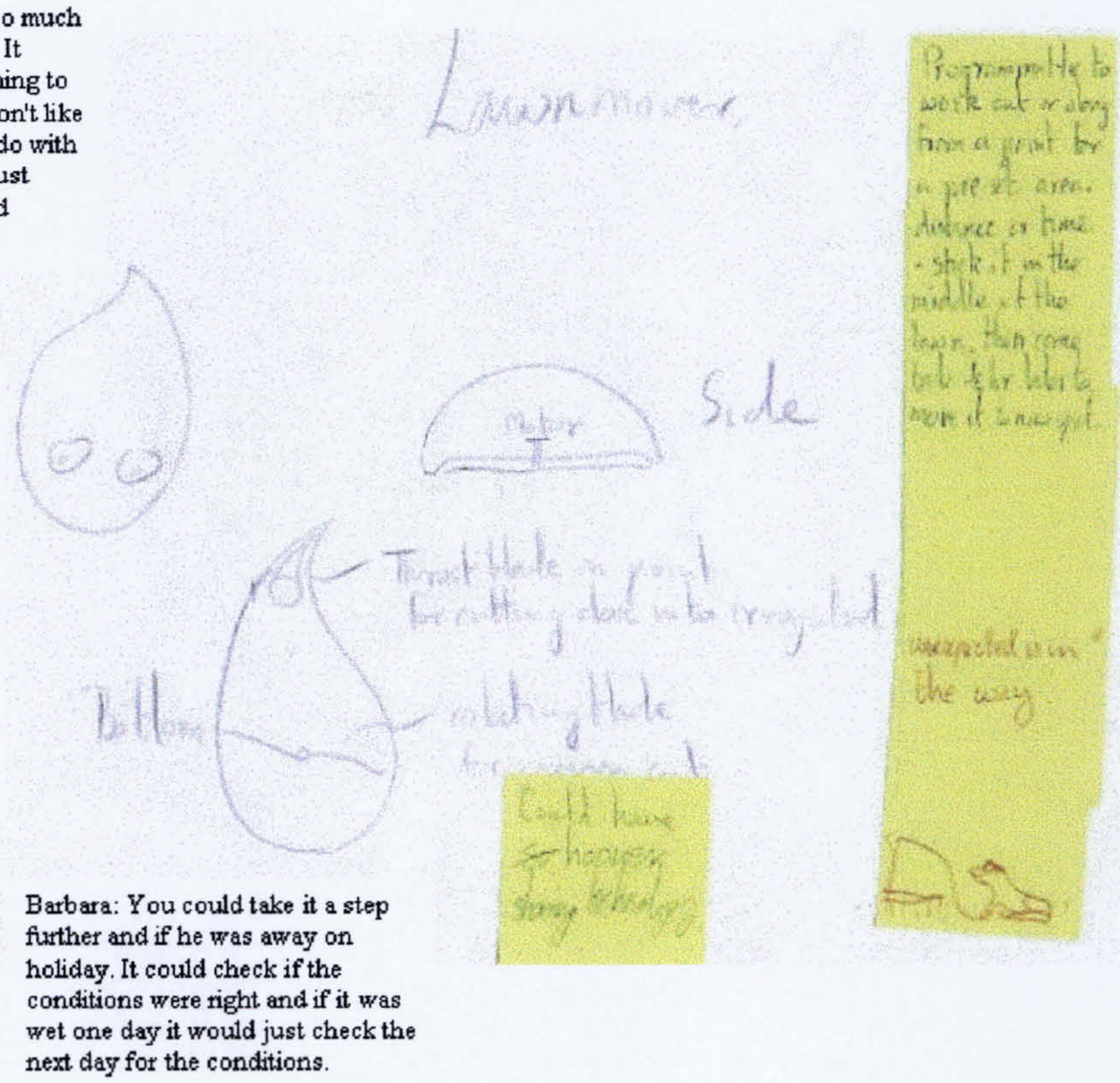
The participants comments about the childrens devices centred around two themes:

1) that a robotic friend/pet could be open to abuse from criminals or perverts, and 2) that the device may have a detrimental effect on a child's development.

Automatic Lawnmower

Catherine: That looks like a good idea. Its not too much of a technical thing. It would be a handy thing to have. I personally don't like having anything to do with gardening so even just cutting the grass and keeping it tidy.

Gordon: If it would check the condition first so it would be aware if it was raining so it wouldn't go out. You could have it in a wee sort of like kennel (his partner starts to laugh) just a wee sort of shelter [Catherine: Fido, the lawnmower] and it could mow the lawn, and it could come out once a week.



Barbara: You could take it a step further and if he was away on holiday. It could check if the conditions were right and if it was wet one day it would just check the next day for the conditions.

Figure 6.19: Critique of Automatic Lawnmower

Gordon and Catherine both seemed too like the concept of Robert Cook's automatic lawnmower. Gordon personalised the lawnmower into a type of pet. Could this be personalisation gone too far? Both Gordon and Catherine can see the utility of the device, with Gordon suggesting ways of changing it. Catherine remarks that the device would free her from having to spend time on gardening, something she says that she doesn't like.

Barbara and Gordon go on to redesign the automatic lawnmower expanding on the comments they made above.

Robot Servant

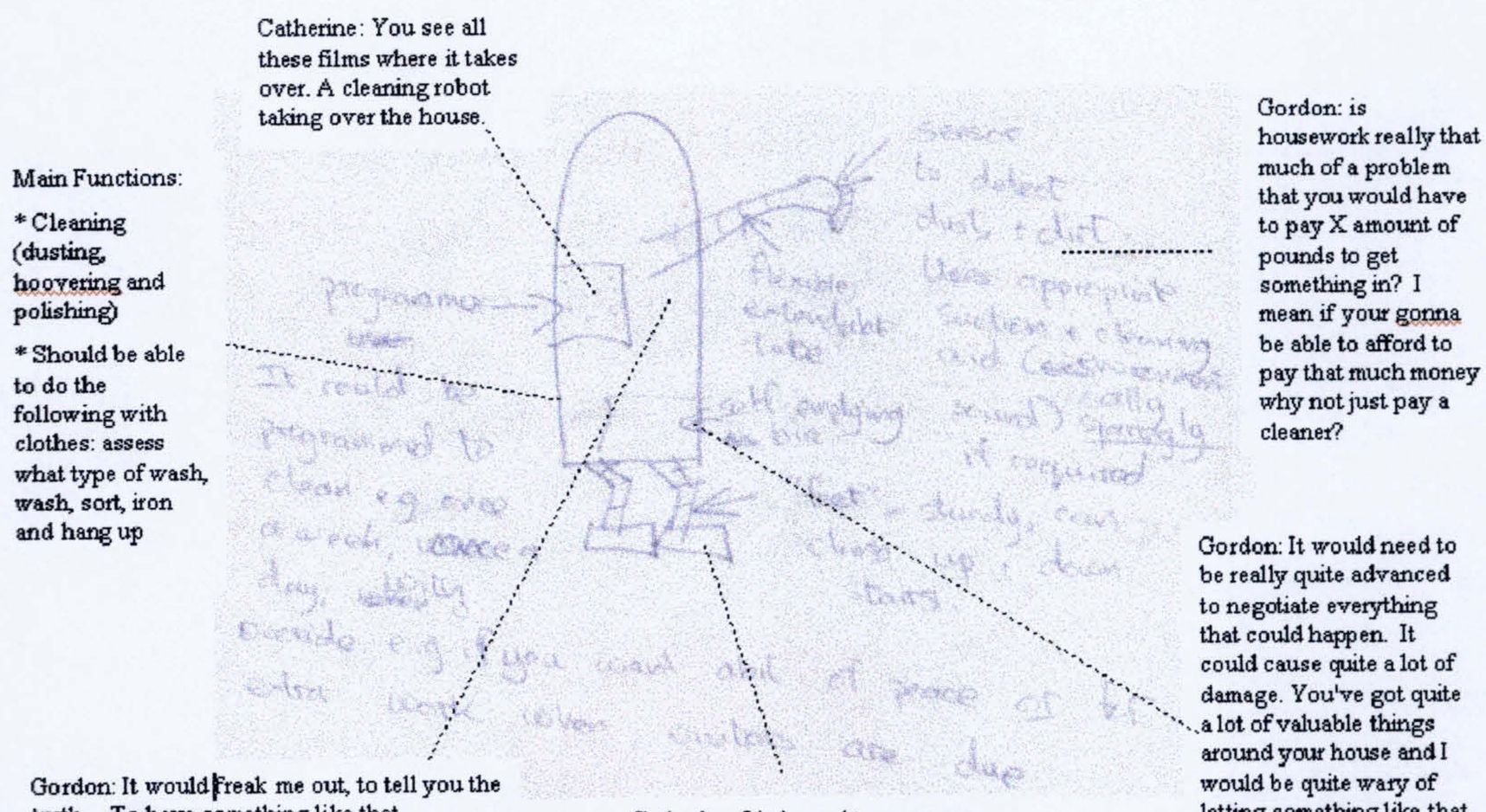


Figure 6.20: Critique of Robot Servant

Gordon and Catherine feel uncomfortable with the concept of a robot moving round their home carrying out housework when they are not there. Gordon queries whether there is a need for such a device and Catherine comments that the device itself may need some kind of maintenance regime. Finally Gordon's comments that a device such as this would have to be quite advanced and knowledgeable about the home and what it contains is very relevant, could a device ever understand the importance of dusting carefully a picture of Melanie and Grant's wedding? The overwhelming impression given by their comments is that they would not like something of this nature in their home. This was also true of the Smiths as they just laughed and said that they would not like it and that it wouldn't work. Agnes Reilly also did not like the concept. Overall no-one redesigned this device, therefore, it could be claimed that the response or lack of it from the participants indicated that this was not a device the participants envisaged or wanted in their homes.

Home Infotainment Centre

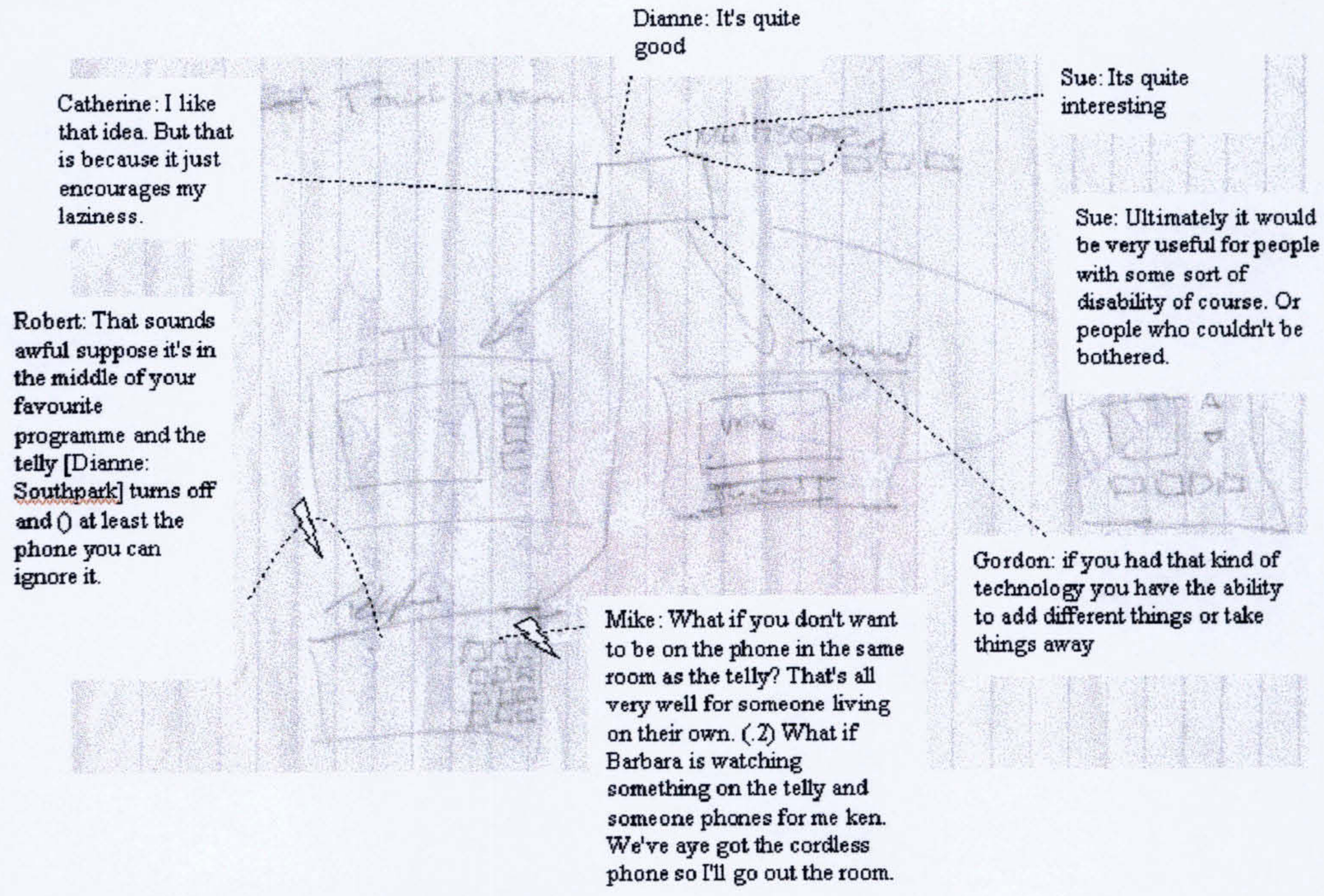


Figure 6.21: Critique of Home Infotainment Centre

Robert remarks that the combination of a television and a telephone, could cause problems for him in the home as it could interrupt his favourite programmes. Robert comments that he normally ignores the phone and that adding a phone to a leisure device is, for him, problematic, as it would interrupt his viewing and make him answer a call. However, Dianne, his daughter, comments that she quite likes the device and does not have a problem with the automatic mode changing. Dianne goes on to re-design this device. Therefore, an good initial impression seems to have had an affect on her choice of, which device to redesign.

Catherine comments that having a device such as this will make her more lazy. However, this is not a deterrent, but a plus! Therefore even though people may comment that a design or device, may make them lazy, this is not always meant as a negative comment.

Gordon's comment showed that he had thought of a way of orientating the design more towards his taste by saying that the device could be bought with some chosen set of functionality and functions added or removed depending on the choices of the user.

Good and bad connotations of the automatic changing of modes have been highlighted, however, for Agnes, who designed the device and who lives on her own, the TV switching to phone mode was not an issue. However, when the device is considered for a household that has more than one member, this aspect of the device can become problematic.

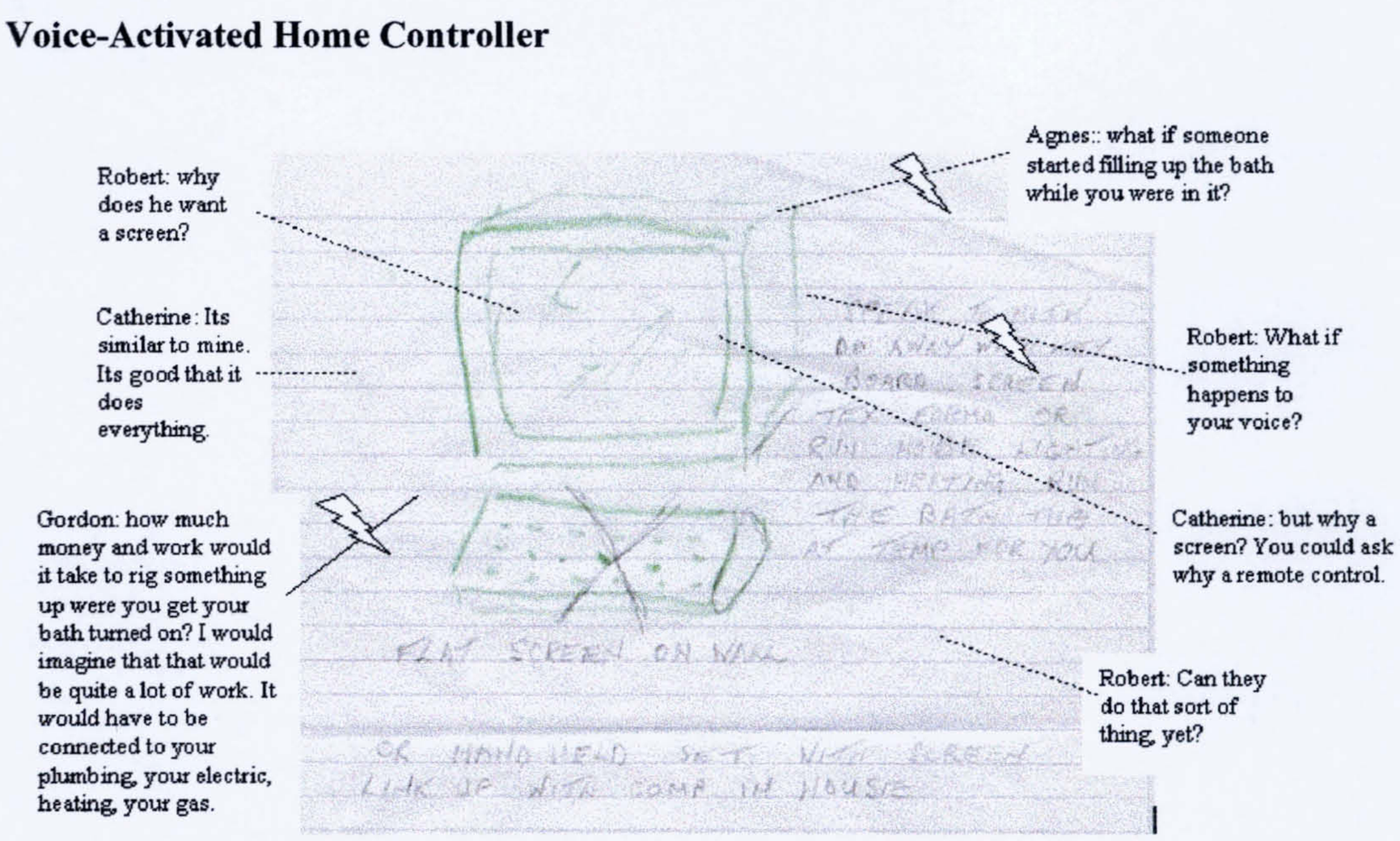


Figure 6.22: Critique of Voice Activated Home Controller

When introduced to Mike's design, Robert Cook remembered that his brother has a voice-activated word processing package that the children may have seen. He reminds the children of this, perhaps in the hope that it will help them to understand Mike's design concept:

> *Robert: Did you try Uncle Billys voice activated thing? When you where up in Crieff?*
> *Dianne: I saw it (.) I wondered why he was talking to the computer ((everyone laughs)).*
> *Robert: You didn't try it yourself? ((Dianne, shakes her head at the question)) No.*
> *Researcher: Would you like something like that? (.) That you could voice activate?*
> *Dianne: Yeah (.5) I am not sure ((she laughs)) (Cook, 7/2/2001)*

The family seem unsure about the concept of talking to a machine. Dianne confirms this, when she says at first that she would like a device which is voice activated but then changes her mind.

Robert thinks that there may be a problem with the voice-activation if someone is ill and their voice is not at its normal pitch or tone. He even asks if this kind of technology exists in a sufficient form yet. No-one else queried the practicality of the voice-activation. Even though Mike has tried to clearly show on the drawing of his design that he does not want any peripherals this concept has not conveyed itself to Robert or Catherine. This is an interesting point and one that probably stems from Mike's original idea that he saw the device as a work-type device which would advise him on the layout of documents, and later changing his mind and making it a device which controlled certain utilities and devices in the home.

Gordon's remarks about the practicalities of a device of this sort are very relevant in that this device would entail a major upheaval of a home, unless the control panel was implemented at the planning stage.

Agnes can see some practical problems with this device in the home setting (see comment in Figure 6.15 above) in that people may inadvertently (or on purpose) ask the device to do something which may affect another person.

Home Larder and Recipe Guide

Main Functions:

* Provide general recipe information

* recipes would be held in a database and searched for by course name i.e. dessert

* Recipes should be in print format so that they can be printed out and used as shopping lists

* Keep track of what is in store cupboards and advise on what is in or out of stock on the list of ingredients

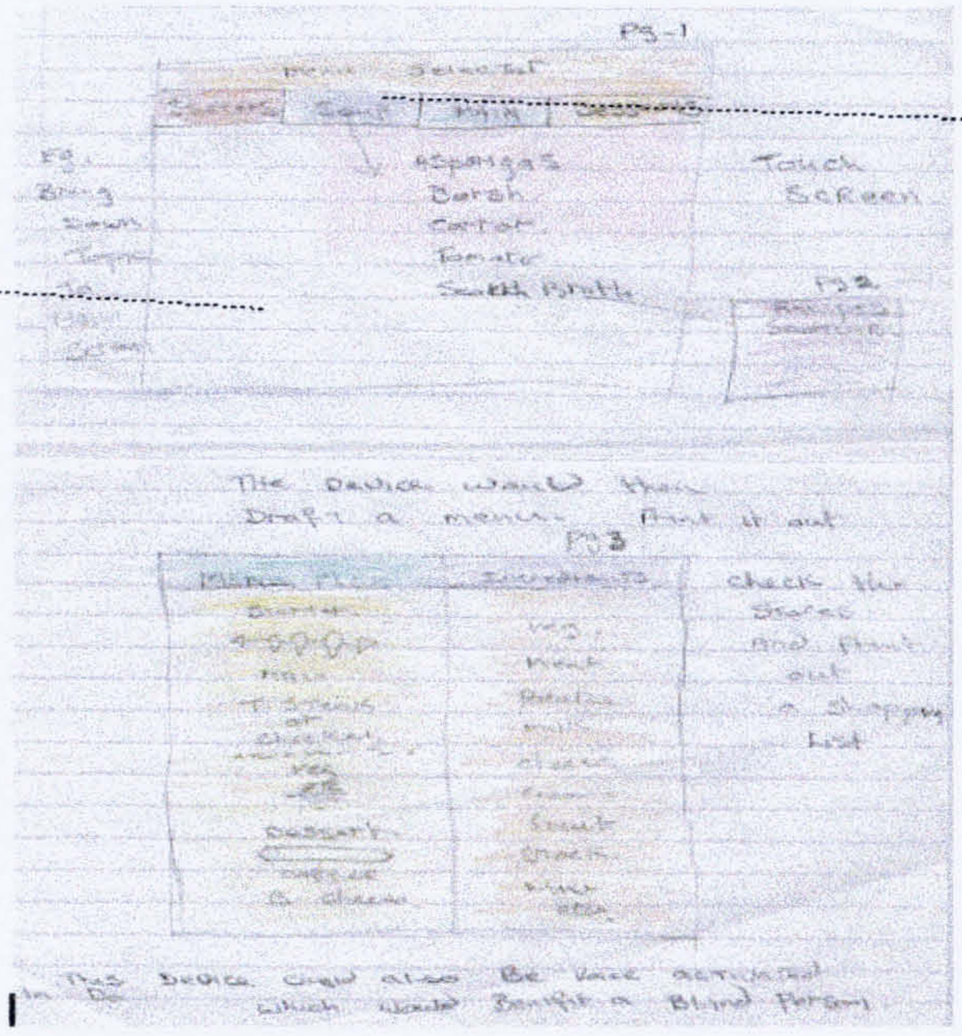


Figure 6.23: Critique of Home Larder and Recipe Guide.

Robert Cook seemed to think quite favourably of Barbara Smith's device. He goes on to redesign this device.

The children were asked for their opinions of the device:

> *Researcher: So do you think it would be good? ((The children look blankly back at me and do not look interested in this device)) No? (.) Not convinced? (Cook, 7/2/2001)*

The children did not seem interested in this device at all. This perhaps goes back to their non-involvement in the food management of the home i.e. they could not envision themselves using such a device and were, therefore, not interested in it.

Gordon, Catherine, and Agnes did not have any comments to make about Barbara's device. This came as something of a surprise as Gordon had designed a recipe device himself and it was thought that he may have more comments to make about this device due to this. Agnes only commented that she couldn't see the need. This device, therefore, only seemed to elicited a response from one person, this was unusual as all the other devices at least sparked a small discussion. The design itself was quite menu driven and did not have many features, therefore, this design may have failed to engage the participants' attention.

Entertainment Centre

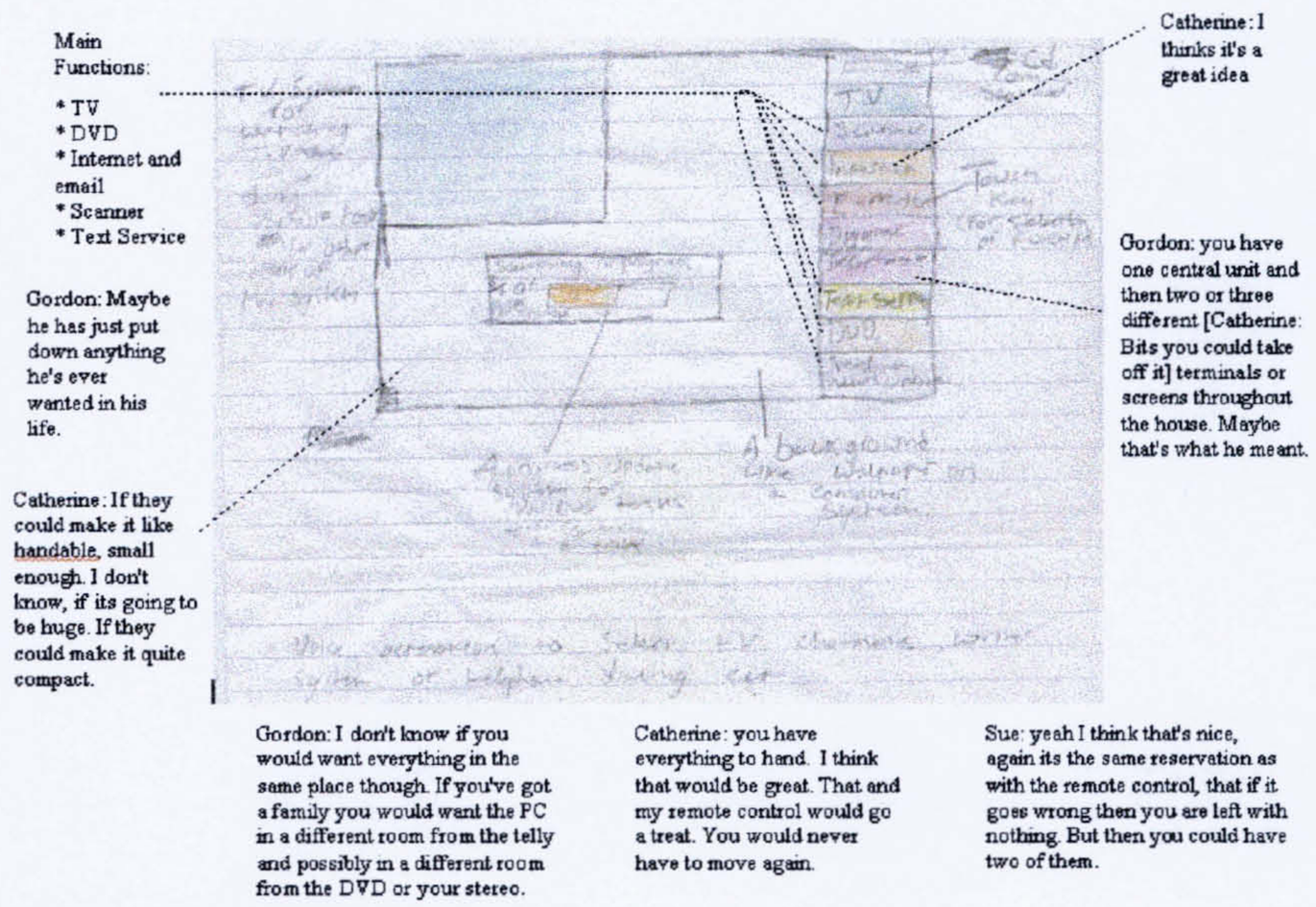


Figure 6.24: Critique of Entertainment Centre

Sue thinks that this device may have a lifecycle problem, in that the device will work fine until something goes wrong with the device and then the user will be deprived of the use of several devices. Some of the participants tried to think through the lifecycle of a device and instances when the device might fail. Participants also mentioned the possibility of adding or deleting functions over time.

Gordon commented that having so much functionality on one device may be especially problematic for people with children, as different family members may want to use the different functions of the device in different places in the home or in fact wish to use one of the functions while someone else uses another. The problem of too much functionality in one device, highlighted by Gordon, was not foreseen by Simon as a problem. Perhaps this was because in his mind he had placed the device in his room, and was only thinking of himself using it, whereas Gordon was thinking of a multi-user situation.

If the participants did not like a device, one strategy they employed was to suggest or think of changes which would adapt the device more towards being a device they would like or want. They also sometimes suggested that the original designer had perhaps meant something else (see Gordon and Catherine comments in Figure 6.23 above).

6.3.2 Re-design

The second part of workshop three consisted of asking the participants to re-design one of the other participant's designs. The participants were asked to choose their favourite design and redesign it. The intention was to gather data about possible new functions and about the use of the designs in their home. Robert and Dianne Cook enjoyed the concept of redesigning so much that they redesigned two devices each, rather than the normal one.

Home/Business Security Device

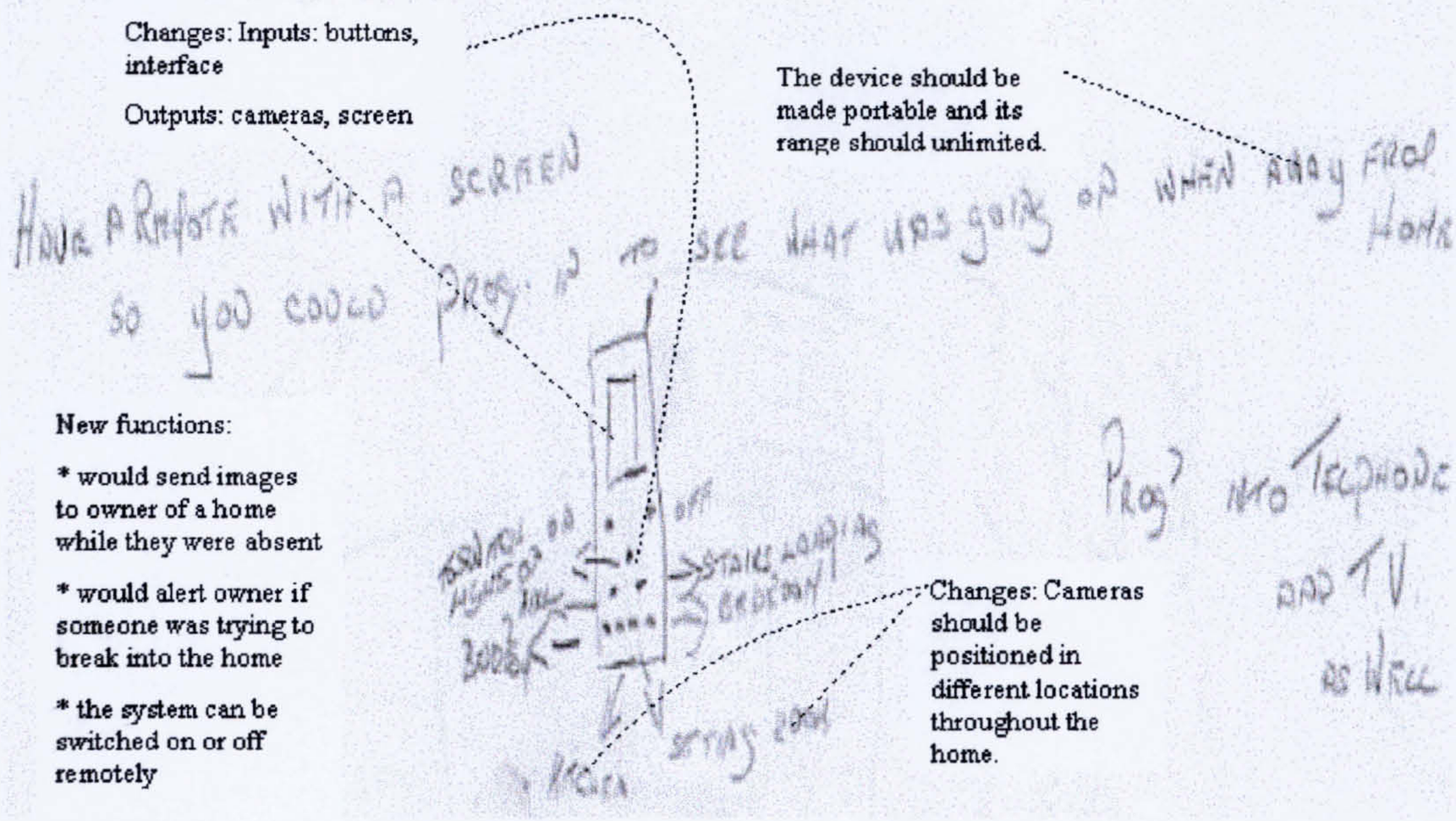


Figure 6.25: Agnes Reilly's redesign of Gordon Petric's Home/Business Monitoring Device

Agnes has added to the security system by adding cameras in various places in the home. She would like to be able to access these cameras from a mobile device and see her home and the various rooms within it. She remarks that this would be particularly useful for people when they go away on holiday as they would be able to take the remote with them, or have a picture sent to their mobile, which would update them on their home. She has moulded the device to fit her needs rather than the needs intended by Gordon e.g. that of giving information to the fire brigade or parents.

Agnes's redesign puts forward the issue of cameras and systems of this nature being present in the home and whether other people, as well as the owner, could access the

system. She has thought about the context of the home in that she has realised that having a camera only at the front door would not be adequate, but she has not thought of any privacy implications. Agnes used the scenario of her going away on holiday as a useful concept, when trying to think of when she would require a device, such as this.

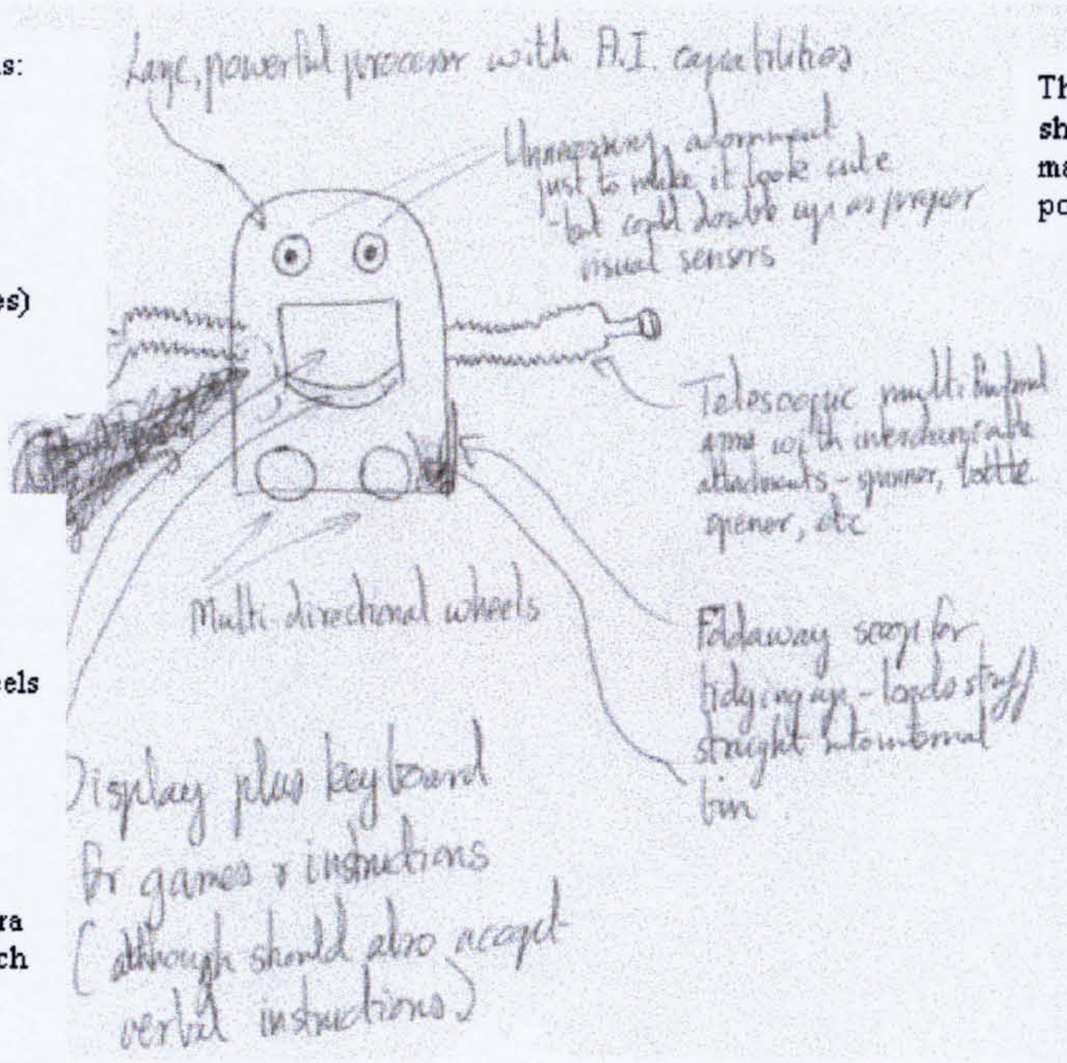
Robot friend

Additional Functions:

* television
* games console
* microwave
* referee (over games)
* music system

Changes:

* the device has been made cuter, to look at.
* multi-directional wheels
* Telescopic arms
* bottle openers,
* razor blades
* the addition of an extra pair of eyes (two on each side of its head)



The device should be made portable.

Inputs: keyboard, voice activation

Outputs: two screens (to enable collaborative game playing and different functions to be used at the same time)

Figure 6.26: Robert Cook's redesign of Tarquin Cook's Robot friend

Robert has redesigned his son's robot friend. He has added many additional features such as: bottle openers and a microwave. This gives the impression that he is redesigning the robot to suit his own needs. It is difficult to imagine a child adding a microwave oven and bottle openers to their playmate robot. Especially when you take into consideration that the children in this study (including Simon, the teenager) did not show any interest in cooking. Robert wants a cuter looking robot than his son; this could be something adults generally do i.e. make a device cuter if it is intended for children. A cuter robot may be what adults, not children, want.

Voice Activated Home Controller

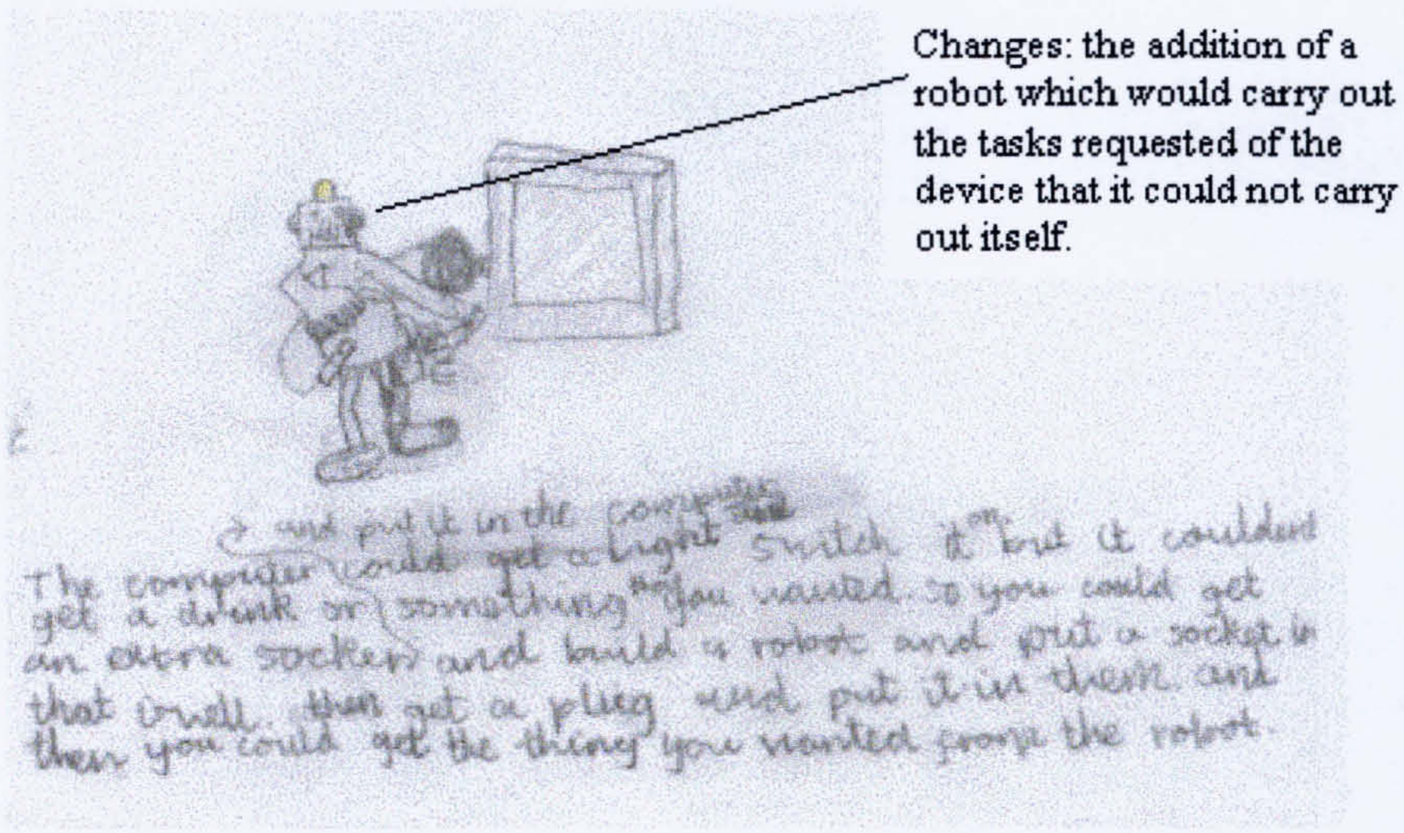


Figure 6.27: Tarquin Cook's redesign of Mike Smith's Voice Activated Home Controller

Tarquin surmised that even if you tell the device to make you a cup of tea, it would have no way of delivering the tea to you. Tarquin's solution was that the machine would send instructions to the kettle to make tea and then a robot would collect the tea and deliver it to whoever had requested it. Tarquin may have had more ideas but his father was urging him and his sister to hurry up. This may have had an affect on their redesigns.

Automatic Lawnmower

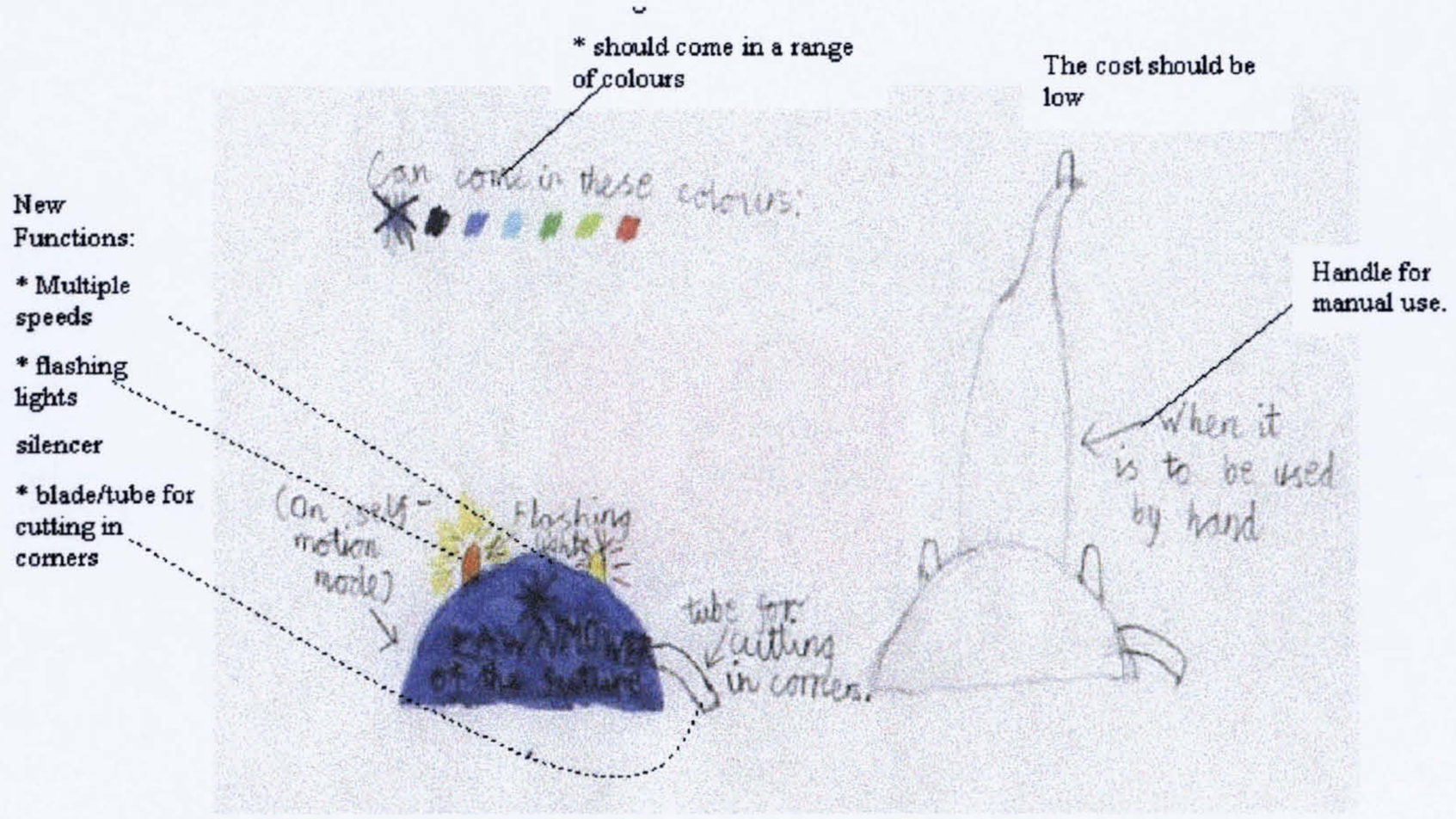


Figure 6.28: Dianne Cook's redesign of Robert Cook's Automatic Lawnmower

Dianne has thought of practical ways to improve the use of the lawnmower. She has introduced personalisation in the form of the availability to pick from a range of colours, rather than just the usual ubiquitous green or orange. She has also added different speeds for different types of terrain in the garden. Dianne has also thought that it should have a flashing light on it so that people could see that the device was working. Dianne also commented that it should be cheap, she is obviously aware of how expensive new devices can be. Dianne also wants it to be quiet, this could be perceived as an indirect criticism of the current situation, in that lawn mowers can be quite noisy. Dianne has thought about the context of the design and how it would be used in real life and the practical problems associated with this.

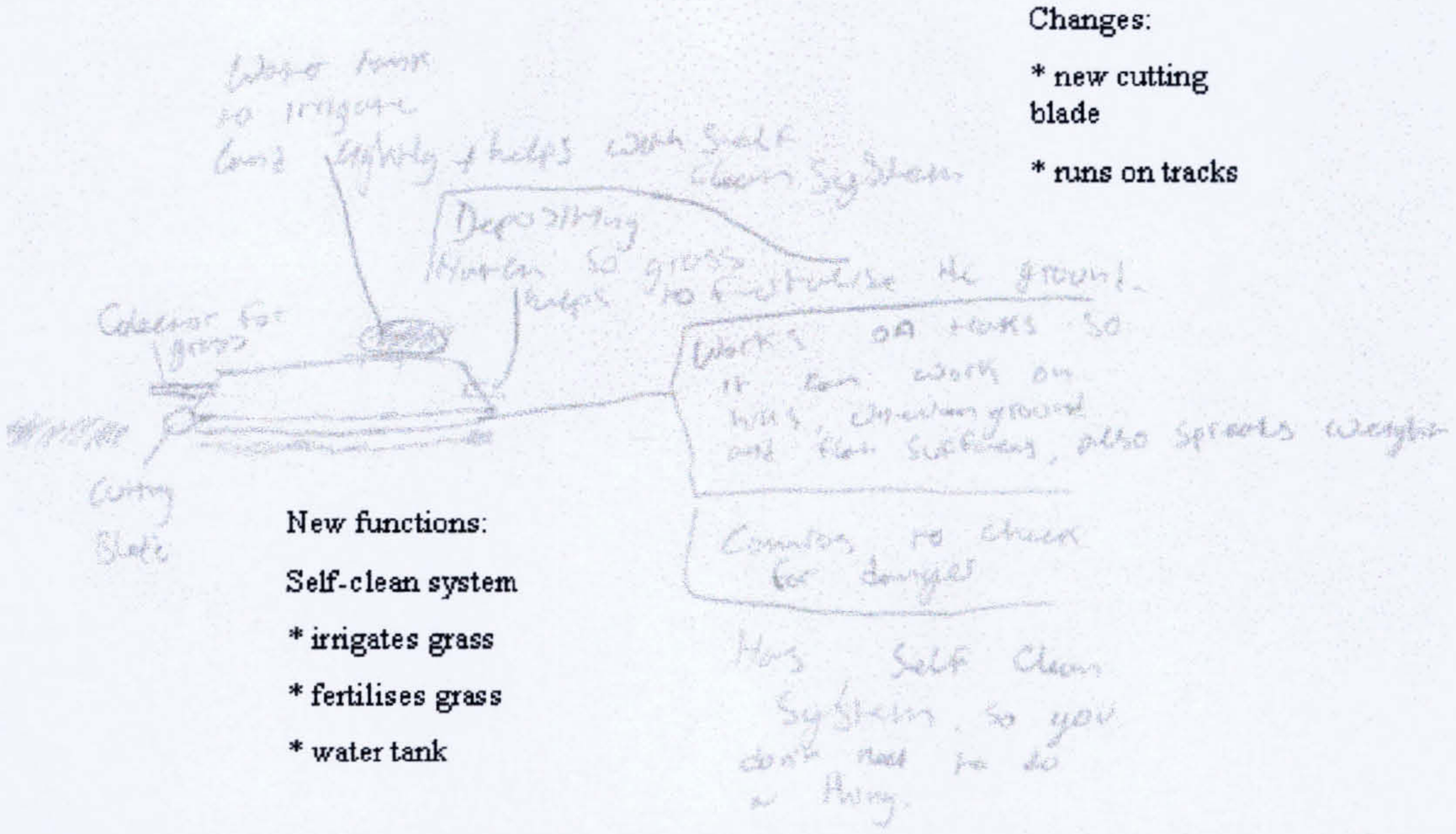


Figure 6.29: Simon Smith's redesign of Robert Cook's Automatic Lawnmower

The main changes Simon made to the design were the ability of the device to irrigate and fertilise the lawn as well as mow it. He also added a self-cleaning system to the design, but did not explain how this would work.

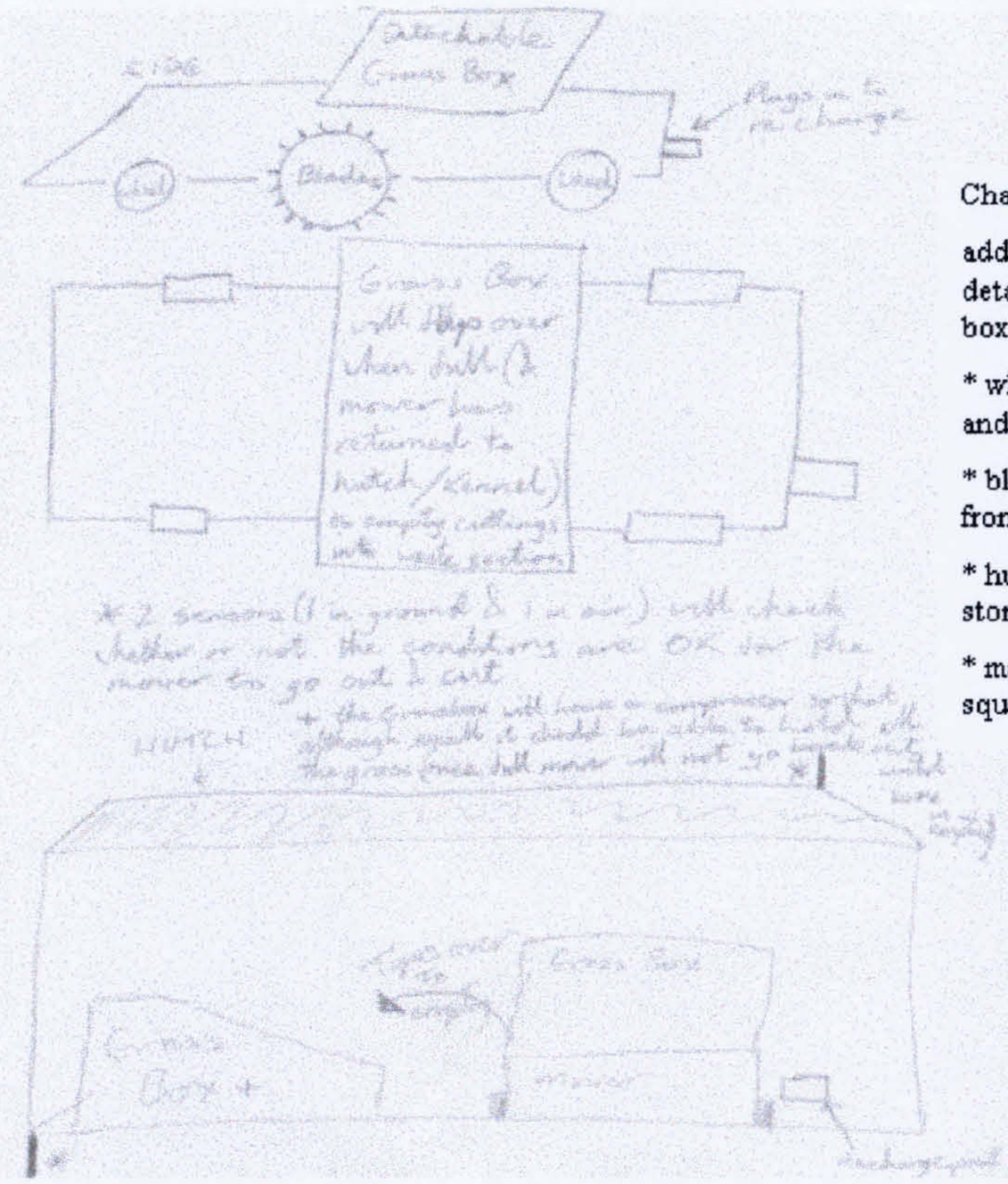
New Functions:

* device recharges itself

* weather sensors (air and moisture)

* grass compressor

* self-emptying system



Changes:

addition of a detachable grass box.

* wheels at front and back

* blades at the front and back

* hutch/kennel to store device

* made into a squarer shape

Figure 6.30: Gordon Petric's Redesign of Robert Cook's Automatic Lawnmower

Gordon added very practical functionality to Robert's device, such as: a grass collecting box which would also act as a compressor, a device to stop the lawnmower working if the grass collecting box was full, a sensor and an aerial to check for optimum grass cutting weather, and a self-charging system. Gordon also talked about the device having a hutch or kennel. His comments could mean that he sees this device as some sort of pet.

New functions:

* sprinkler system
* weather sensor
* automated plant feeding reservoirs
* automated shading system for greenhouse
* lawn irrigator

Changes:

* addition of a rake
* colour should be red

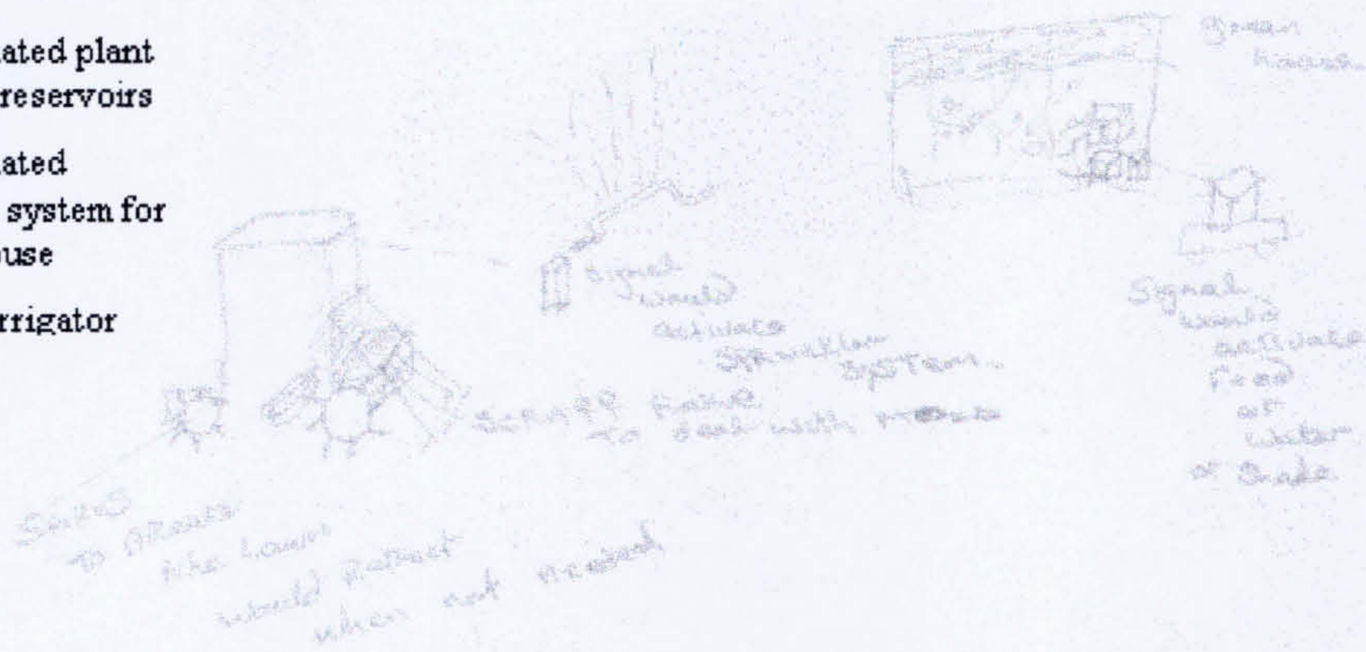


Figure 6.31: Barbara Smith's Redesign of Robert Cook's Automatic Lawnmower

Barbara's redesign of the automatic lawnmower focuses at first on the lawnmower and has added the ability to irrigate and water the lawn as well as mow it. However, she moved on from this concept to one of a whole garden system.

Home Infotainment Centre

New Functions:

* voice activation
* remote telephone dialling from the remote control
* DVD
* VCR

Changes:

* Larger screen
* detachable speakers
* remote control

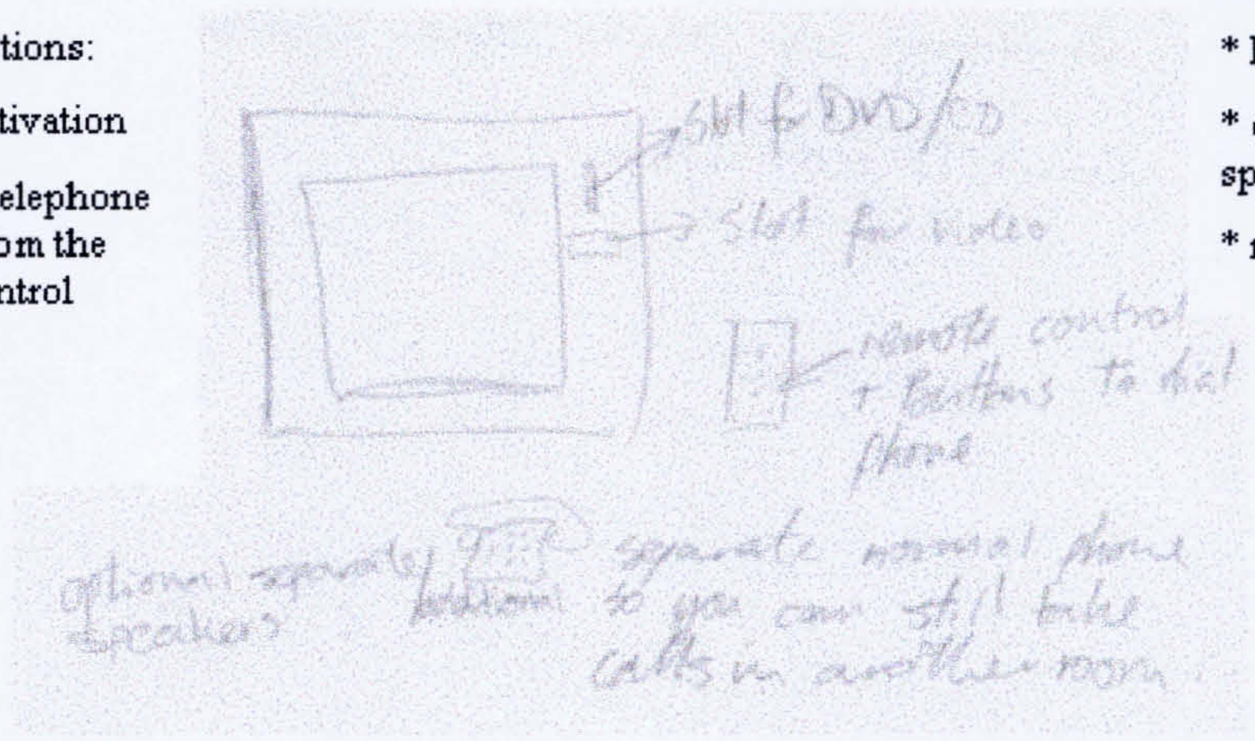
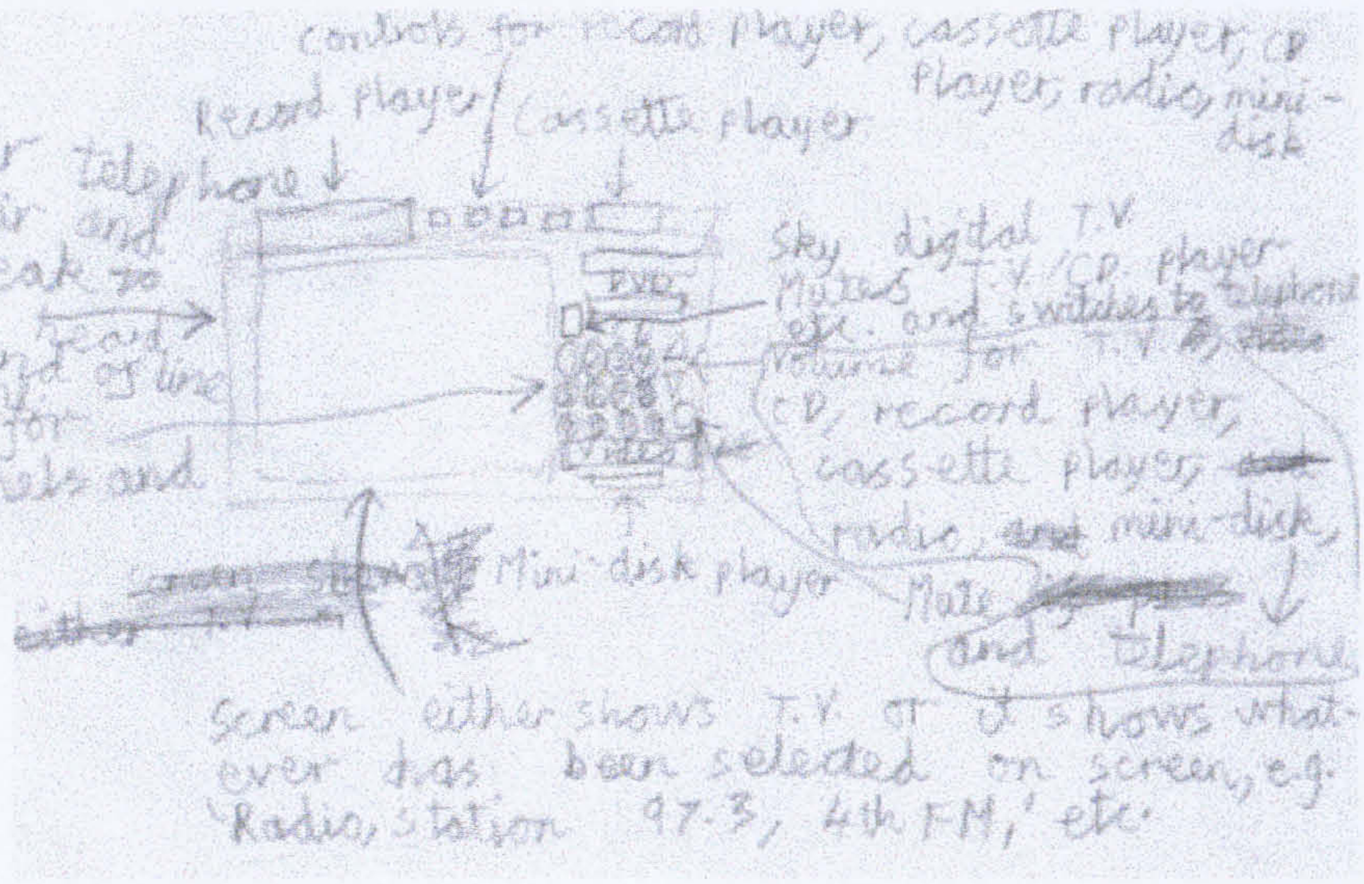


Figure 6.32: Catherine Naysmith's redesign of Agnes Reilly's Home Infotainment Centre

Catherine has made Agnes's screen a little larger. The addition of a larger screen may be problematic for a device that would be situated in a kitchen.

Catherine has added functions to the device perhaps thinking that this device would be situated in a living room and did not given consideration to the device being in another location. The additional functions may make the device difficult to use, or understand, as the device is already a multifunctional device. Catherine has added a remote and the ability to make calls through the remote as well as answer calls. This is an interesting addition of functionality and flexibility i.e. the ability to detach the phone and move around and also to make calls through the remote. This is a similar redesign to the one carried out by Tarquin in that Tarquin and Catherine have managed to include some of their own original design's into someone else's design.



New functions:

* DVD Player
* VCR
* CD-Player
* voice activation

Figure 6.33: Dianne Cook's redesign of Agnes Reilly's Home Infotainment Centre

Dianne re-designed the home infotainment device in a similar way to Catherine in that she added some additional functions, such as a tape-recorder and DVD-player.

Catherine and Dianne both assumed that the positioning of the device was in a living room-type environment. This was not what Agnes thought, she envisioned the device being in the kitchen. The addition of a large screen, DVD and CD player may not be suitable for a kitchen environment. It could be supposed that if Catherine and Dianne had known that the device was designed for the kitchen, they may not have redesigned the device in the way they did.

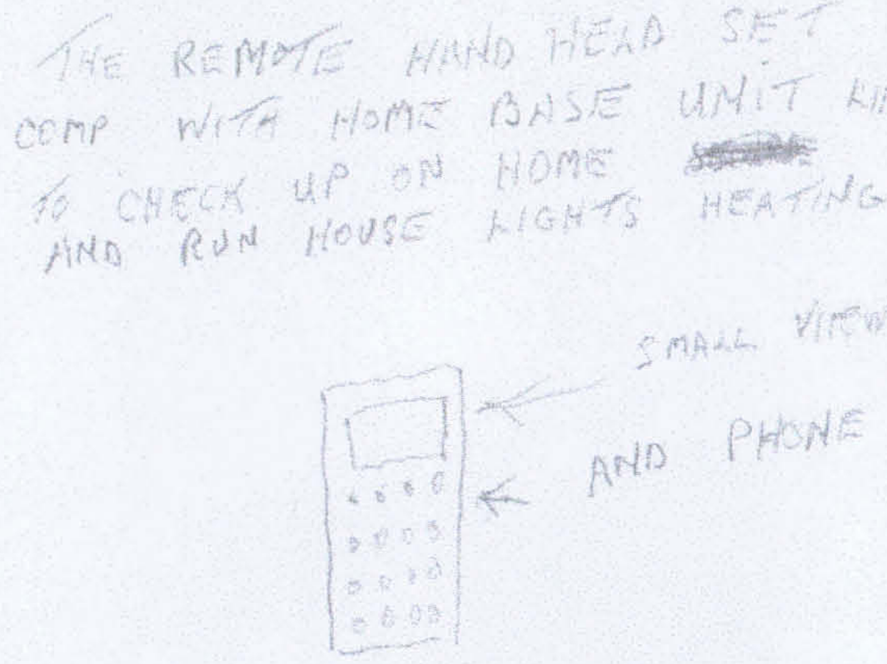


Figure: 6.34: Mike Smith's Redesign

Mike had chosen one system to remodel and instead of remodelling it he actually remodelled another one. He did not seem to fully grasp the concept of redesigning a device. He was the only participant that had problems with the re-design:

Researcher: H:::m but you have been remodelling a different one.
Mike: I've been wanting a handheld set.
Researcher: But what you have been looking at is the remote the universal remote.
Mike: Aye.
Researcher: Uhuh. That was the security system. They are two different designs.
Mike: Link up with the house, so it links up with your house up an aw that.
Researcher: So you've been redesigning Naysmith's one and not Petric's one?
Mike: Naw its that one I want a small phone as well and a screen.
Researcher: But its really the security part?
Mike: Yeah. That's what I've got ((he is pointing at his drawing)).

His redesign was muddled and poorly thought out from start to finish. Mike clearly did not have a clear idea of what he wanted. He also did not give a clear explanation of his redesign. In addition he was the only person who did not have a clear concept for a device in the design session.

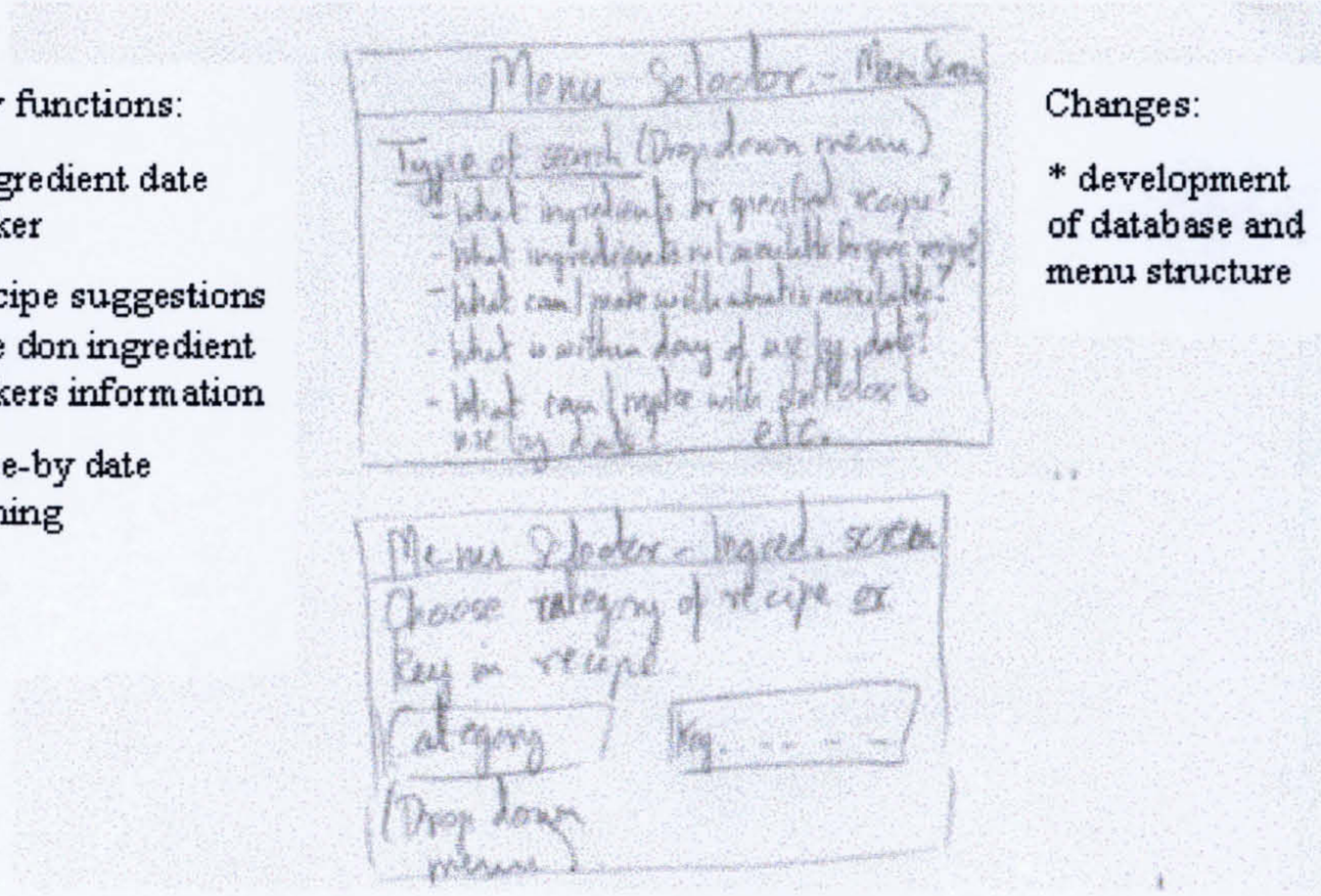
Home Larder and Recipe Device

New functions:

* ingredient date tracker

* recipe suggestions base don ingredient trackers information

* use-by date warning



Changes:

* development of database and menu structure

Figure 6.35: Robert Cook's redesign of Barbara Smith's Home Larder and Recipe Device

Robert redesigned the system so that it was much more based on the design of a database, which was what Barbara had intended (see design section) Robert has progressed the design and shown how it could be made into a working prototype for a system. However, in his redesign he does not take into account the context of the situation i.e. the fact that the device is to be placed in the kitchen. He dwells almost entirely on working through a scenario, of wanting to make something to eat from the ingredients in the kitchen.

Entertainment Centre

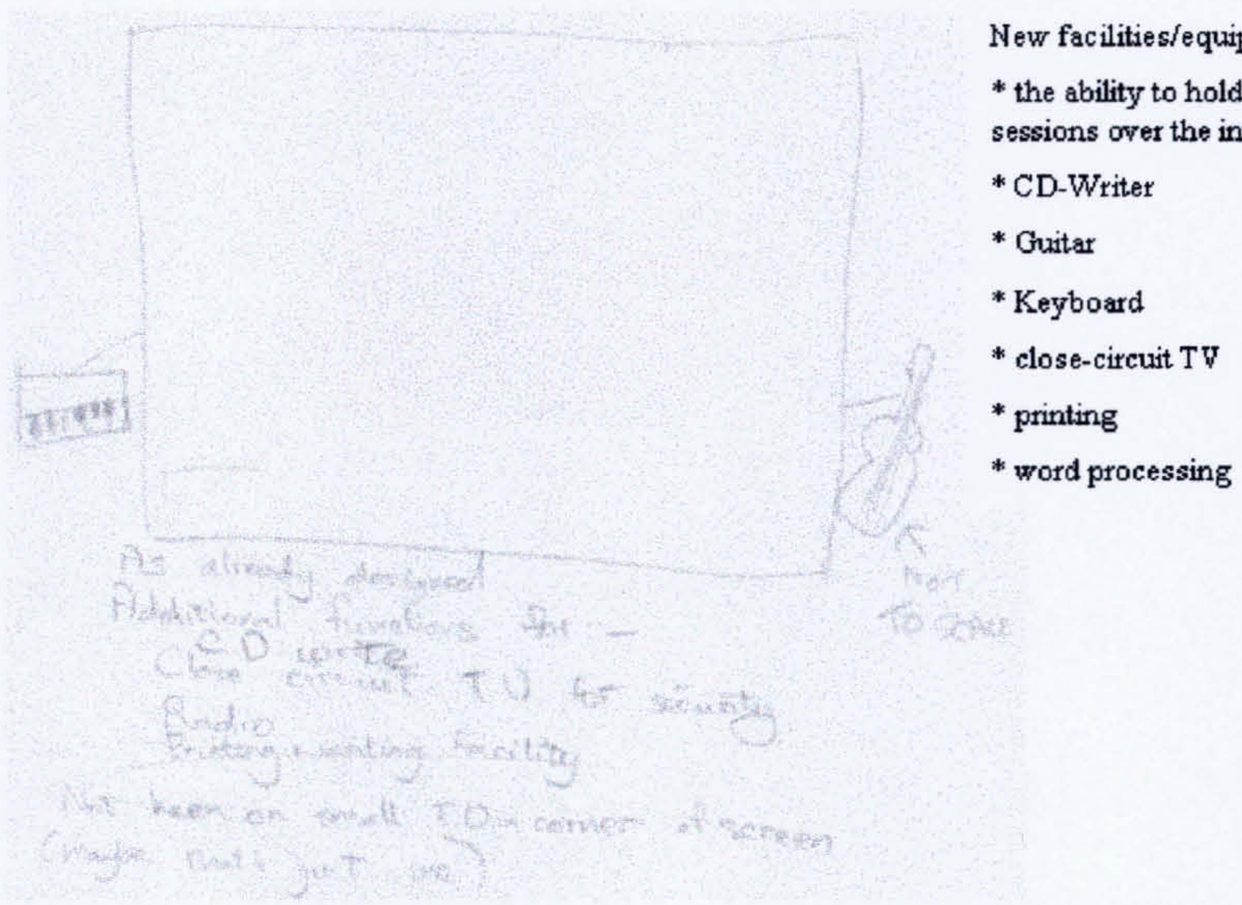


Figure 6.36: Sue Cook's redesign of Simon Smith's Entertainment Centre

Sue has added some additional functions to Simon's design, perhaps a system with this many functions would end up confusing the user. Sue has also added a security feature to the device Sue comments that this could be done with some close circuit television cameras. It is to be wondered whether this function would be necessary on a device such as this. It could be claimed that Sue is just adding more and more functionality rather than redesigning. It is interesting then that it was Sue in the critique stage who pointed out that adding more functionality into a single device could cause problems if the device broke down.

6.4 Summary

This chapter presented data gathered from the second and third workshops. The aim of the second workshop was to contextualise ideas in home and daily life by materialising ideas for future technologies. The aim of the third workshop was twofold: firstly to sharing design concepts across families and to modify and elaborate on the participants' design concepts. Each technique and the information found as a result of each technique is briefly summarised, a fuller analysis of the findings is provided in Chapter 7.

6.4.1 Design

The concepts behind the design session were twofold: to elicit requirements for the design of future wants for devices and to encourage less articulate and hesitant participants to engage in the discussion. It was thought that children may especially fall into this category. Issues highlighted by the design session were:

- Personalisation: two of the participants felt that personalisation was important to their devices (Catherine and Dianne) and that their devices should not only be offered in one colour or facia design.
- Ease of use: two of the participants added quick menus and colour coding to their devices to aid ease of use (Simon and Barbara).
- Context: some of the participants thought about the context in which the device was going to be situated, and designed their device accordingly (Gordon, recipe device).
- Utility: the ability to update the device was thought to be important to the utility of a device particularly the ability to delete or add functions and update content.
- Automation: having a home system or robot carry out tasks on the user's behalf (Sue, Tarquin, Emily) or alerting the user to problems (Peter and Gordon's monitoring systems).
- Interaction: many modes of interaction were thought of by the participants, some wanted the interaction to be more fun and pleasurable. Some of the modes of interaction included in the design concepts were: tracker-balls, joy-sticks, touch and voice. The means of output was also thought of in more fun or different ways for the home e.g. flashing lights, pop-up screens and audio cues.
- Privacy: the protection of their own privacy and property was important (Peter and Gordon).
- Friend: wanting a device to be a pet or a friend.
- Multi-functional devices: devices that had a myriad of functions seemed to be favoured by participants who either lived alone or were thinking about using the device exclusively themselves, for example, elder (Agnes) living on her own, and teenager (Simon) designing a device to go in his room.
- Space and Place: participants thought through where the concept device would be placed. They had very definite opinions of what was a good or a bad place for placement of a device. A definite place in the home for the envisioned design had usually been picked out.
- Demonstrating the design: designs were demonstrated by verbal descriptions, mime, and gesture. Additionally some of the participants would conduct a

walkthrough of how they conducted the task at the moment and how they would carry out the task in the future using their envisioned device.

6.4.2 Critique

The critique aimed to find out which requirements were extrapolated across families and which were not, and also what problems and issues the participants have with the concepts being scoped. Issues highlighted by the critique session were:

- New designs: ideas for the re-design of the design concepts would spring from the critique discussion.
- Lazy: a device taking over a task was sometimes deemed as good if it saved the participant from carrying out tasks they did not enjoy. Some even commented that this could make them more lazy but this was not seen as a problem, with the exception of children where people were not happy if a device took over tasks from children as this was seen as affecting the child's development.
- Life cycle: too much functionality on one device was deemed a problem as it could lead to major disruption in the home if the device broke down (Sue on Simon's device)
- Space and Place: space and multi-functional devices was seen as an issue as it would overload a space in the home if everyone wanted to use the device at the same time (Gordon on Simon's device).
- Personalisation: this could be a source of dissatisfaction with two of the participants saying that they did not like a device because of its ideas about colour. However, another participant did like this concept and found it a source of inspiration in that she could colour co-ordinate her remotes to match different rooms.
- Interaction: worries about the robustness of different forms of interaction were voiced, especially in the case of voice interaction.
- Control: some devices raised issues over control of a device when modes would change automatically, (Robert on Agnes device). Some raised issues over who was in control of the device (Catherine's universal remote, Mikes home controller) i.e. the person currently issuing commands, the previous user, the parents, or the device.
- Concept: comparing design concepts against their own design concept, or other devices they currently owned, was a common theme and seemed to help the participants to better understand the other participants' design concepts.
- Tasks: the possible addition of tasks e.g. maintenance, deletion of tasks from children, was seen as problematic.
- Privacy: concerns raised over home monitoring and monitoring of neighbours' homes.

- Utility: is technology robust enough to handle some of these concepts. Participants would sometimes try to walkthrough a typical-use scenario: Robert and Sue discussing Peter's home warning device, Catherine and Gordon discussing Sue's maid, to see what the implications of use or acquisition might be.

6.4.3 Re-design

The purpose of the re-design session was to solidify what people did or did not want from these concepts and whether or not any new possible requirements would emerge from another participant. Issues highlighted by the re-design session were:

- Space and place: inappropriate additions of functions for the intended location or device, e.g. adding of a security system to a home infotainment device, which is to be located in a bedroom. Large screens for a device to be located in the kitchen.
- Functions: the addition of functions for no apparent reason or rationale. This problem is often found when designing by committee.
- End user: some of the redesigns tended to be redesigned not to improve the design but to suit the needs of the participant doing the redesign
- Interaction: adding more ways to interact with a device, more screens, buttons, remotes, etc. This usually, in contrast to the adding of more functions, led to more flexibility e.g. more than one person could use the device at a time (Robert and Tarquin's robot).
- Assimilation: this process was carried out by two of the participants when they managed to assimilate their original design concept into the redesign.

The designs and re-designs did elicit requirements for devices in the home. Most of redesigns did progress the original concept of the design by adding practical functions such as more cameras to a home security device so that the whole home could be viewed. The participant would sometimes carryout a walkthrough of the device to show how the whole task would be carried out.

7 Critical Reflection of the Home Workshop and Data Collected

'Most of life', says Mr Forster, 'is so dull that there is nothing to be said about it'; the fact remains that real life is chaotic and formless, and the artist is faced with the problem of confining his impressions of that life into a space which is infinitely smaller than itself and with at least one of the dimensions removed. He has no other alternative, therefore, than to select what seems to him its most significant parts, and to arrange the chaos into some sort of an order. Inevitably the life he presents is something much neater and tidier than the diffuse reality. (Peter Burra's, 1924 Introduction to the Everyman Edition of A Passage to India, E.M Forster pIIV)

7.1. Introduction

The first section of this chapter will draw conclusions from the workshops reported in chapters five and six (see section 7.3 and 7.4). The data collected from the workshops was analysed using grounded theory (see section 7.2) and the Ethnograph software package. The next section will assess the success of the Home Workshop as a method for gathering data in the home. Finally a comparison of this method with other methods currently used in the home to facilitate investigations will be made.

7.2 Data Analysis

This section gives an explanation of how the data analyses were conducted, including the tools and methods that were used.

7.2.1 Approach Chosen and Justification

The setting for the investigation was in real households as this was thought to be the ideal site for investigations into people's relationships with technology in the home. Researchers (Suchman and Trigg, 1991) have commented that studying naturally occurring practices in situ is preferable to settings contrived by researchers. However, this very situatidness can sometimes lead to problems with the analysis of the resulting data, as the setting is not controlled or controllable.

Researchers have also commented that the bias of a researcher and the bias of the establishment from where the methods of analysis have sprung can affect the research, for example: *'The researcher engaged in research... is not in search of (objective, scientific) truth, but the construction of interpretations, of certain ways of understanding the world, always historically located, subjective and relative.' (Ang, 1996, p47).* Any analysis conducted could therefore be biased and certain issues are simplified or excluded depending on who is undertaking the analysis.

This work undertook studies in peoples homes, however the strength of a field study, its ability to give rich descriptions of social settings, can also be its weakness as there can be a tendency towards an anecdotal approach to the reporting of the data.

Bryman (1988) thought that there were grounds for disquiet in this approach as the findings may not be representative or generalisable. It is fair to point out, however, as Vidich did, that:

'Lurking behind each method of research is the personal equation supplied to the setting by the individual observer. In this fundamental sense all research methods are at bottom qualitative and are, for that matter, equally objective; the use of quantitative data or mathematical procedures does not eliminate the inter-subjective element that underlies research. Objectivity resides not in a method, per se, but in the framing of the research problem wherever the data and their hunches may lead.' (Vidich, 1955 p346)

It is impossible, therefore, to carry out research of any kind without biases being present. However, safeguards should be in place to ensure that as accurate a representation as possible is presented.

It was important that the data collected i.e. the video tapes, Post-it notes and the hand written notes were coded and analysed in a standard manner, which would give validity to any of the findings. However, it was also important that any findings could be attributed directly to the words and comments of the participants, as Silverman stated: *'In qualitative research one is unconcerned with standardising interpretation of data. Rather, our goal has been to retain good access to the words of the subjects, without relying upon the memory of the interviewers or data analysts.'* (Silverman, 1993, p107). Qualitative research studies tend to result in a large amount of data being collected. As a naive researcher it was felt that any analysis carried out was bound to be biased so the researcher felt that it was important- as Silverman had stated- to try and stay as close to actual words spoken by the participants. How then to analyse this mass of data? Wynn (1991) commented that one way of dealing with this situation was to be more trusting of one's own competence to make sense out of a less structured, more diverse mass of data and to tolerate a temporary confusion in perusing this mass until the picture emerges. A possible solution is to use methods that have proven to work in other projects (for a comprehensive list and description of various methods for interpreting qualitative data see Silverman, 1993) and one such theory was Grounded Theory. Grounded Theory used in conjunction with Ethnograph (Ethnograph is a program for the analysis of text based data, it helps the researcher to: compile, organise and manipulate large quantities of data) was thought to be the best method for analysing the data.

7.2.2 Sensitising concepts guiding the gathering and coding of the data

One of the key concepts in HCI is 'usability'. In BS EN ISO 9241 the definition of usability is: The effectiveness, efficiency and satisfaction with which specified users achieve specified goals in particular environments (BS EN ISO 9241, 1998, p4). The following goals of usability are generally recognised by HCI practitioners:

- effective to use (effectiveness)
- efficient to use (efficiency)
- safe to use (safety)
- have good utility (utility)
- easy to learn (learnability)

These have all been highlighted as usability goals by: Neilson, 1999; Preece et al., 2002; Dix et al., 1993. These goals were thought to be important to any investigation into our relationship with technology in the home. The way these goals informed the analysis is outlined below. Another important way of analysing the data to learn more about how we use and view our technologies was to look for the highlighting of spaces as important to use. As can be seen by the figures and analysis in Chapter 5 the householders' view of the space was important to their use of the technology within it. The coding of spaces was informed by other researchers' work and how it was used in the analysis of the data is outlined below.

Usability and user experience goals

The components of usability and user experience goals were important to use in any analysis of the data to see if indeed the home workshops had discovered problems with the families' current technologies. By searching through the transcripts for instances of the main usability goals it was hoped that more could be learned about the usability and design of home technologies and what the families did or did not want from their technologies. Further it was hoped that the designs produced by the families would fulfil some of these goals. It was also hoped that the families would be able to critique other families' designs in a way that would make the designs more usable and enjoyable.

Spaces in the home

The data were analysed for comments and signs of the importance of spaces in the home. As Venkatesh (1996) has pointed out (see Chapter 3) the social space is important as it constitutes the social structure of the home and the technological space is important as it represents the technological nature of the home. O'Brien et al. (1999) also mentioned the importance of space in the home, however he thought that homes were socially-organised spaces and that spaces could change depending on the activity, time of day, or family member using them, while Silverstone (1994) highlighted the importance of the location of a device. It was of interest to the work to see if it would be apparent during the sessions that certain spaces and locations were important in families' homes. Whether or not space or location was felt to be important was a focus for the second and third workshop i.e. were spaces important when critiquing and discussing new concepts for design? The transcripts were studied for indicators of space, location, and place. The transcripts were also studied to see if there were indicators as to the different uses of space at different times.

The analysis of the data tried to stay close to the actual words used by the participants in order to provide themes that were true to the data gathered. The data could of course be analysed in many different ways and other themes could be found. However it would remain true that the themes reported in 7.3 and 7.4 are based on actual responses and data e.g. drawings and post-its, supplied by the families.

Some of the code words and example quotations from the families are given in table 7.1. The code words presented in the table are the most common ones found as a result of the analysis. Fifty seven code words were found in total as result of the first phase of the analysis as the analysis continued the number of code words gradually reduced.

Code Name	Number of times the code was found	Example Quote
Control	76	*Robert: this is your old Atari isn't it? ((He is talking to his children. There is a small TV with an Atari games console beside it)).* *Tarquin & Dianne: Yes* *Robert: They use it for games* *Lynne: Do you still use it?* *Dianne: It's old and its attached to the TV. Yeah, which means we can't always use it ((looks at her father)).* *Robert: That was a reason of course, if I wanted to watch TV and they wanted to play games, they had to stop playing.*
Cost	47	*Gordon: It is quite limited and they've got their own sort of search engine and all the rest of it, which takes too long to find sites. It's just not worth the time plus you are sitting with your phone (.) running up your phone bill it's charged at local call rates, I think, but you still don't want to be sitting on it for half an hour at a time.*
Inter-action	65	*Emily: The TV is difficult to tune because of the small... what do you call it, the thing you hold ((Emily is pointing at the TV and making a shape in her hand)) (.15) the remote control ((laughs and puts her head in her hands)), the TV control. To tune in the TV takes forever. I would prefer to do it some other way.*
Learning	82	*Lynne: Do you use the printer or the scanner?* *Dianne: I don't know how to use the printer or the scanner.* *Tarquin: I don't know how to use them. No one has shown us.* *Dianne: And we don't know where a manual is or how to learn.*
Lifecycle	41	*Emily: It took me nearly a whole day, there were two bits of plastic sticking up that way ((she is miming what she was trying to do with the phone)). I tried to fit the batteries in, I could see the mark on the batteries where this thing was and I just thought to hang I am fed up with this I'll need to get someone to try and fix-it and I just put the battery down on top of it like that ((mimes a slamming down of her hand onto the phone)) and it slotted right in.*
Privacy	20	*Mike: I'm not bothered about privacy. What's going to be private? Nothing's going to be private in the future anyway is there?*
Utility	78	*Sue: The dryer is a bit ancient, the door doesn't stay on properly, but if you get it right then you can get it to work* *Lynne: So how long has it lasted for?* *Sue: Oh a long time (.2) must be probably about fifteen years.*
Space & Place	157	*Lynne: Why have you placed the devices in this room in the way you have?* *Agnes: See the fridge is stupid there. The kitchen has been laid out in this way because of the sockets ((Agnes is pointing to the different sets of sockets around the room)).* *Lynne: would you have placed the sockets in these locations?* *Agnes: No. They were just put there, they never used to be there, it's only since.(.2) it's only in the last year that those sockets have been put in.* *Lynne: So did you have any input into where the sockets were going to be?* *Agnes: No*
Auto-mation	46	*Peter: So the screen would come out with a signal and then you would be able to see the text of it. So a visual thing like that on the wall like a light flashing if a door bell rings.[Lynne: Uhuh]In case you cant hear the doorbell or you've left the oven on too long. I would want the light to flash and then for the display to pop up. It would be moveable. Yeah (.2) it would have to be cause if it was down the stairs and you heard the bell or seen the flash you would say to hang wi it. It could be in your lounge, your bedroom, or your kitchen. It could be in the toilet also!*
Mobility	62	*Sue Cook: I have got this u::m (.) tape and radio. But I am afraid only the radio works now.[Lynne: Right]* *Sue: As you can see it has seen better days.* *Lynne: Why have you still got it?* *Sue: I can move it around, the other one ((Sue points to the sound system in the corner)) has to stay where it is.*
Person-alisation	55	*Catherine: Yeah, it is remote control [Lynne: Uhuh]. But not something big, but I couldn't think of any other way to get all the buttons. But the user should be able to choose. Possibly a wee mouse button thing ((she is making circular motions near the bottom of the remote)) (.) or a tracker ball. Yeah that's the one so that you can move round the screen. People should be able to choose the design. Mine has got spots on it.*

Table 7.1: Some of the code words found as a result of the analysis and example quotations.

7.2.3 Grounded Theory

This theory was thought to be suitable for the analysis of the home workshops because its focus is on the data collected. Further, grounded theory presumes that whatever framework or methods you employ in the field new ideas and issues will arise and the theory allows for these to be incorporated into the analysis and findings. The part of grounded theory that was used was the constant comparative method (Glaser & Strauss, 1967), the method has four stages:

1) Comparing incidents applicable to each category (for example learning: 'I didn't read the manual', I learnt as I was going along' and noting in Ethnograph that these excerpts related to learning).
The defining rule for the constant comparative method is that while coding an incident for a category, it should be compared with previous incidents in the same and different categories (this was carried out in this study by carrying out searches on codes words).
An incident can also be coded for several categories (An example of when this was done was with the Atari games console in the Cook's home. The father said that the games console was not used as often as the children would like, because he had control over the television, which the games console needed to be attached to, whereas the children said that they did not use the machine because it was old therefore two of the code words used in this incident where: control and lifecycle). However, grounded theory does insist that upon further analysis the researcher should realise that while an incident may pertain to other categories, its main thrust or point is focused only on one category.

2) Integrating categories and their properties: this process starts out in a small way; short notes and memos are taken. But as coding continues, these notes should change to become parts of categories that have been found as a result of the initial comparison of incidents. This was done by setting instances side by side, the commonalities and distinctive features among them were then made more visible.

3) Delimiting the categories: taking out non-relevant properties, integrating elaborating details of properties into the major outline of interrelated categories. This should result in a reduction of categories.

4) Writing Theory: At this stage in the process of qualitative analysis, the analyst possesses coded data, a series of memos, and a set of categories, these should become the major themes of the findings presented. (Adapted from: Glaser & Strauss, 1967, p105).

Table 7.2 presents the themes found as a result of undertaking the grounded analysis.

Name	Contents
Control	*Control was found to be an important mediator in the use of devices in the home. This theme examines how the participants felt towards or used a device dependent on their control over it.*
Cost	*The issue revealed in this theme was that running cost not purchase costs, were found to be the major factor in the acquisition and use of a device. The theme examines exactly what affect these running costs had on the use of a device and the participants' view of it.*
Interaction	*This theme reports on how users are frustrated by the inappropriate choice of input devices supplied by manufacturers. An inappropriate choice of input device by a manufacturer was found to annoy and frustrate the participants. The participants wanted this situation to change in the future. Further they wanted their interaction with devices in the future to be more fun, enjoyable and entertaining.*
Learning	*How we learn to use a device is vitally important in terms of its long term use. It was found that the participants currently do not use the tools provided by manufacturers. Further that the tools provided were inappropriate for the home setting. Interesting and innovative ways of improving this situation were provided by the participants.*
Lifecycle	*This theme discusses the participants' attitude towards a device during its lifecycle and how this was found to be mediated by two issues: the participant's stage in their lifecycle and the ease with, which the device could be maintained and upgraded over its lifecycle.*
Privacy	*All issues surrounding privacy and security in the home are discussed in this theme. The analysis found that the participants wanted to be able to control the access to a device and the information stored on that device. In the future some of the participants thought that they may be willing to give up their privacy in order to gain tangible benefits from manufacturers.*
Utility	*Utility has been raised as an important usability goal and as an important attribute of system acceptability. Utility was also found to be an important theme in the home workshop sessions i.e. participants were able to articulate why a device was unused due to its poor utility.*
Space & Place	*The space and place theme encompassed the participants' thoughts on how they currently used the different spaces in the home and how that affected the use of the technology within it. The use of space by different family members was also explored, as was the use of space at different times of the day. Finally the importance of place is explored and the affect placement has on devices in the home.*
Automation	*More than half of the devices envisioned by the participants had some form of automation. This theme examines what features of automation were welcomed by the participants and which were felt to be inappropriate for the home and why.*
Mobility	*The ability to move devices freely without the hindrance of wires and sockets was raised in the workshop. This theme explorers what affect the mobilisation of devices could have on the home as envisioned by the participants.*
Personalisation	*The ways in which the different participants envisaged personalisation of devices to evolve in the future is reported in this theme.*

Table 7.2: A short guide to the themes that emerged as a result of the grounded analysis

7.3. The present use of technology in the home

The methods employed to discover households' current use of technology and their relationship with it were the technology tour, scenarios and Post-its. From the information provided physical and artefact models were drawn (see Chapter 5). This gave indications of the current problems with technology but also more importantly gave an overview of the use of that technology in context. The transcripts and models were then analysed as outlined in Section 7.2. From this analysis the following major themes emerged as important indicators of the current design issues that surround these households use of technology.

7.3.1 Control

Control manifested itself in many ways in the participants comments about technologies throughout the workshop sessions. There are three main issues that emerged from the control theme: space, parental control, control over the device. Space and control are discussed in Section 7.3.8.

Parents were sometimes in control over or mediated the use of certain technologies in the home. For example it was found in the technology tour, that the father's control over the only television set meant that the children could not use or had to stop using a games console (Figure 5.8). Non control over certain aspects of a device could also lead to negative feelings about a device. For example, Dianne was in general very happy with her CD-player, however, she became unhappy when she used the radio function on the device because she had to wait and see if the radio station would play the tune she wanted, this she found very frustrating (Figure 5.10)

The issues for design are :

* control over functions can be an issue with technology

* if a technology needs to be used in conjunction with another quite separate technology (i.e. this excludes peripherals) this may cause the technology not to be used.

7.3.2 Cost

The participants thoughts about cost were found not to be limited to the purchase cost but were found to extended to the running costs during the lifecycle of a device. While this shows a parallel between home finances and acquisition of home technologies, that was also a finding of Venkatesh (1996), it highlights a point worth noting in that it was not the purchase cost that affected the use of the device but the running costs. If the running costs were known and some functions/service were cheaper than others the cheaper services were used the most, and in this case almost exclusively e.g. Catherine and Gordon's use of text messaging rather than make phone calls because texting was cheaper. The other effect is that the device can run into disuse if the running cost are not known e.g. Gordon and Catherine bought a particular games console (Dreamcast) over a rival games console (Playstation) because the Dreamcast had internet and email access. This device had poor usability but in addition Gordon mentioned that he did not

know the running costs of their internet access and preferred to go to an internet cafe where he paid a flat rate for access and, therefore, did know the costs.

At the moment some manufacturers, especially games manufacturers, are using a 'shavers and blades' strategy that is: sell the initial product e.g. shaver or the console at a discount price, and recoup your losses by charging a higher price for the games or blades that need to be used with it. Users are aware that the costs have shifted from the product to the service and do not seem to have a problem with this strategy. However, what is a problem is that these costs are hidden and remain hidden, the result being that the technology or services remain unused because of the possible costs of use.

7.3.3 Interaction

We have always interacted with products, what is more difficult to assess is the level of satisfaction with that interaction. Some manufacturers merely build or market a device without understanding fully that what they may be ultimately judged by is the quality of the interaction these products or services provide. The workshop helped uncover good and bad modes of interaction with present technology.

A problem with the mode of interaction with one device was highlighted by one of the participants. She found that tuning in her television was something she found difficult to do with her remote control (Figure 5.1). Monageg and Wagner (2000) suggested that tasks performed infrequently should be even easier to carry out than tasks carried out frequently.

Perhaps the television should offer more than one method for tuning? A remote control may be appropriate for changing channels, and adjusting sound etc, but inappropriate for carrying out more demanding tasks such as tuning.

Methods of interaction were found to have an impact on whether something is acceptable socially or not. For example, when working through the scenario session with Barbara Smith she commented that she may want to interact with her phone as a normal phone, a video phone, or a conference phone, depending on the situation (Figure 5.17). Her husband comments that with their current phone they can answer the phone in the nude. Their comments helped to highlight a potential problem with a proposed mode of interaction for the home.

These findings suggest that designers should be aware that people can clearly see the implications for use in the home which they may have missed. For example in one study of the home the researchers had built a model home with a three quarters length mirror. No one mentioned in their study any potential problems with privacy. The comments made by people in a real home, however, show that while participants may like to use a video screen on a phone in some circumstances, in others, it would be inappropriate.

7.3.4 Learning

How we learn to use a technology in the home does not seem to have been investigated in any depth in the home. The studies highlighted in chapters two and three, did not investigate or make any remarks about this issue. Most of the devices studied in the home, with the exception of computers, have not required sustained interaction from the user. However new interactive devices will require sustained interaction from a user and not just one user but multiple users. There is a clear need to know, therefore, how people learn to use a technology in the home. Learnability is also one of the goals of usability and, therefore it is important to understand how people learn to use technologies in the home. The home workshop made three main findings concerned with how people learn to use devices in the home at the present time: the use and non-use of manuals, time available to learn, and problems with one-of inductions.

Manuals

The main tool offered by most manufacturers to enable buyers to understand a new device is a user manual. Manuals were found not to be read in the households participating in this study (Figures 5.4 and 5.7). In one case the participants only used the manual to carry out the initial installation, even when they started to encounter problems with the device, they still did not refer back to the user manual. In another case a family had acquired a new digital television, all bar one of the family members had not read the user manual. However, this did not deter them from going ahead and use their new digital television. These findings provided an indication of what people do, in practice, with manuals in the home. Other researchers have also found that users don't read manuals (Carroll and Rosson, 1996; Neilson, 1993). Pirsig postulated that perhaps the reason we do not read and in fact cannot relate to manuals is because manuals are written as

spectator manuals: *'here is the machine, isolated in time and in space from everything else in the universe. It has no relationship to you, you have no relationship to it.'* (Pirsig, 1974, p34).

One-off induction

The one-user-one set-up scenario often encountered with new devices and in particular with computers had an effect on the use of a technology by the children in one family (Figure 5.11). The children in the Cook family said that they did not know how to use the family printer and scanner. It would seem that this non-use was not intentional but the consequence of neither of the parents realising that the children did not know how to use them. However, it would seem unreasonable for manufacturers to rely on first user of a machine to teach the next users how to use it.

Time

Time constraints were another factor which mediated the amount learnt about a new technology. For example, the Smith parents (Figure 5.4) commented that they had not had the time available to learn about their new digital television because they did not have any spare time available because of work commitments. There are competing demands on peoples time in the home, such as, hobbies, meal preparation, household tasks etc, which may have an effect on the amount of time they have available to devote to learning a new technology.

How we really learn in the home

Participants were found to compare new devices against what they know about older versions of the same or similar. This certainly seemed to be the way the Smiths learned to use their new digital television. Their new television in design, general appearance, and functionality looked exactly like an average analogue television. Could the lack of learning, therefore be due to its similarity to the old television? It could be postulated that the Smiths did not feel the need to learn about their new television because it looked and acted in exactly the same way as the old one.

This theme has highlighted that designers and manufacturers need to improve the current way people learn how to use devices in the home. If we are trying to design inclusively then there should be some way for users, who come to use a device for the first time, to be given a tour of the facilities. We seem to expect

only one person to be the sole and only user of a device in the home. Even in a recent study by Monageg and Wagner (2000), no consideration was given to a multi-user induction set-up for learning. They only considered a one user set-up and induction session for a device for the home. It would be an unusual home device that was only ever used by one person, even in the case of gendered devices, such as washing machines, other members of the family do occasionally use them.

The designers should be aware that:

* people in all probability will not read the manual. The design implication of this is that if you want users to use the new functions and facilities provided, then other ways of informing users of how to use these devices, out-with, the user manual will have to be found.

* designers should be wary of only assessing the use of technology in the laboratory as this could lead to a lack of discussion about more than one user situations, further these sessions tend to involve 'typical users' using the technology something that does not always happen in the home. They should instead assess these technologies in the context in which they will be used and with a wider group of users.

* people in the home do not always have the time available to take part in one long induction session, therefore, alternatives should be available.

7.3.5 Lifecycle

Some lifecycle issues surrounding the use of technology in the home were discovered. For example, in one case it was found that the utility of the device would decrease rapidly with age as the device was not updateable (Figure 5.7). In another case one of the participants retold a story of how she had problems replacing the batteries in her phone, and tuning in her television via the remote control (Figure 5.1) these were both tasks which were carried out rarely in the devices lifecycle but had a massive impact on use if not carried out correctly. Another participant expressed the wish to be able to carry out minor repairs to her devices (Figure 5.9). These incidents and comments imply that devices at the moment are not being designed to allow users to quickly undertake routine maintenance or updates. This situation could be improved by designers:

* giving users clear and unambiguous instructions as to how to carry out routine maintenance tasks.

* undertaking studies in situ to determine whether or not an input device is appropriate for carrying out a particular maintenance task. This may help to uncover different issues with different age groups in undertaking tasks or steps that have been missed out when the device was initially assessed in the lab.

* paying more attention to the lifecycle of a device. With the advent of interactive technologies e.g. digital television, the problems that the historical use of the internet brings, become apparent e.g. the inability of these devices to download plug-ins.

In conclusion these findings show that the whole of the device lifecycle should be thought through when designing a device. Also tasks and general maintenance that need to be undertaken should perhaps be easier to undertake than tasks we do more often.

7.3.6 Privacy

Privacy was an interesting issue and one which was brought up rarely, but in interesting ways, during the workshops. For example in the technology tour it was interesting to note that the young couple (Figure 5.7) had individual passwords and emails for their games console, whereas families e.g. the Smiths (Figure 5.8) and the Cooks (Figure 5.10) did not use passwords to allow access to the family PC. It would seem that the young couple, in this instance, may have wanted to maintain some privacy, while families did not, Harper et al. (2002) also found this to be the case with families in their home study.

In another excerpt one of the families during the scenario pointed out that video-phones may not always be appropriate in the home setting as people walk about in states of undress.

The findings for design from this are that people want the option over whether the device protects their privacy or not. For example the families chose not to have passwords, but the young couple did, as they still wanted to maintain a level of individuality. The idea of a video-phone was welcomed but it should be easily controlled so that the screen could be turned on or off depending on the situation.

7.3.7 Utility

This concept of utility has been raised as an important usability goal and as an important attribute of system acceptability. Utility was found to be important in the home. For example participants were able to articulate the usefulness of different functions on a device, and describe why a device was unused due to its poor utility.

Unused devices were found during the first workshop. There were many reasons given for this e.g. members of the family do not know how to use it (printer and scanner, Figure 5.8), use of the device was limited because of positioning in the home (PC, Figure 5.5), the device no longer worked (vacuum cleaner, Figure 5.11), the design of the device itself rendered it unusable (games console, Figure 5.7). The internet and email facilities were largely unused on a games console mainly because of the poorly designed interface (Figure 5.7). The makers of the device seemed to have ignored all the basic tenets of good design, in that the interface was difficult to learn and put a heavy cognitive load on the user. For example, no text names for the icons or ones with no generally accepted meaning such as 'vortex', also the interface required the user to carry out more steps than was necessary e.g. six steps to delete an email. This meant that the device was not efficient to use. The main utility problems were it was not updateable, this resulted in its level of utility decreasing over time, and the interface design, which led to poor user throughput.

Even though HCI has been advocating user evaluations and usability testing for years: some systems are still being designed and marketed without, it could be presumed, the most basic of evaluations being carried out. This led to the device not being satisfying, helpful, motivating, emotionally fulfilling, rewarding, or supportive of creativity. In terms of usability it was not easy to learn, easy to remember, efficient to use, or have good utility. It could be argued that it is safe to use, however, it is to be wondered whether this was all the users were looking for in their new interactive games console. The implication for design is that thorough user evaluations and usability testing are essential otherwise the device will not be used.

Another device that was unused in this home was a telephone, which was still in its box. When asked why the father commented that the telephone had been given

to them as a gift (Figure 5.8). The fact that it was a gift could be the reason for its non-use i.e. they did not like the telephone, for whatever reason, but did not feel comfortable throwing it away as it was a gift.

The Cooks also seemed perfectly happy with the problematic tumble dryer (the door was no longer attached to the machine). The device offered good enough utility but was perhaps not 'safe to use'! Designers and researchers who undertake studies in the home should, therefore, be wary of merely viewing and noting down devices present in the home as we could be making assumptions about a devices, which are not correct as the householder or family may use often devices that look as if they are falling apart and use seldom or not at all fairly new devices.

Some devices become wanted and find a new utility, that wasn't present before which provide users with a new reason to acquire it., for example Petric and Naysmith mentioned that they wanted a PC but couldn't afford one and thought the games console would provide a good compromise as it gave them the features that they wanted in a PC e.g. access to the internet and email. Could it be construed from this that the PC has at last found a place in the home as a communication device (as highlighted by Venkatesh, 1996)? People in recent years have started to use their PC's not to carry out word-processing or home financial management, but to access the internet. The majority of people access the internet and email from home not work (Towler, 2001). However, if all we want to do with a PC in the home is email then it may not be a suitable tool, for two reasons:

1) Sometimes placement is in an inappropriate place to allow other family members access (Figure 5.5)

2) It is complex machine which can easily go wrong and therefore is not easy to learn or maintain.

However, this study has also highlighted that changing access to the Internet from a PC to a games console is also fraught with problems, which had not been thought of by the designers or manufacturers of the device.

The suggestion for design is that it is clear that people want a device that will allow them quick and easy access to the internet and email (Smith, Petric and Naysmith) the problem is how to make that 'want' a reality. So far the offerings

from the market place have been poor. For example, the Dreamcast was a failure (for all the reasons highlighted above) and went out of business. The other offering is digital television so far 97% of the people who have the ability to email through their television have never done so. Therefore, two questions need to be thought through when designing a new facility for a device in the home:

- Is it an appropriate device for the function/service to be added to?
- has the interface design been well thought through and thoroughly evaluated in context?

Functions

There are many issues surrounding functions e.g. appropriateness of functions, use or non-use of functions, too many or too few functions. Manufacturers have been criticised for adding extra functions as a marketing ploy rather than a real attempt to improve the device (Noyes and Baber, 1999). The finding from this workshop was that the participants could articulate what was an appropriate and useful function and what was a wasteful and redundant function. For example, during the first workshop it became clear that the participants did not use some of the functions available on their devices (digital television (Figure 5.4) games console (Figure 5.7)). Some of the existing devices in the scenario session were multifunctional devices, such as diaries cum address books. These multifunctional devices seemed to suit their users needs in easy to use artefacts. The finding for design is that even though some people will see the benefit of having a new digital gadget or device, for some the device/artefact they use at the moment is perfectly suited to the tasks they wish to carry out. A home workshop can help to uncover what devices are supporting a task well and which are not.

7.3.8 Space and Place

The importance of space and place cannot be underemphasized when it comes to the home context. The majority of research studies that have been conducted in the home agree that an understanding of space is crucial to understanding our relationship with objects and technology in the home (Venkatesh, 1996; Csikszentmihalyi and Rochberg-Halton, 1981; O'Brien et al., 1999; Harper et al., 2002; Miller, 1995).The first home workshop also found that spaces were

important in the home and that they had a profound affect on the participants relationship and use of technology.

Space

Access to a space was sometimes decided upon by the social aspects of the home i.e. work spaces being in corners of rooms so that they wouldn't get disturbed by the day to day activities in the home (this can be seen in Figures 5.4 and 5.9). The mother not wanting to access or invade her son's space so that she can use and learn more about the computer (Figure 5.5) . The children in the Cook family seeing a part of a room as an entertainment and social space and the father viewing that space as a work space (Figures: 5.9 and 5.10).

Some these spaces were far from ideal e.g. Simon's workspace was high tech with lots of devices to help him in his studies, but lacked adequate light. In the Cook home the father saw a space as a workspace but the children saw it as a leisure space this meant that he had to clear the children's games away every time he wanted to carry out some work. Mike Smith's workspace was cramped but it was the only place available for a work space in their small home, and was out of the way of passers by.

Venkatesh mentioned that there is a blurring taking place between the boundaries of spaces in the home. No evidence for this was found in the home workshops. Agnes Reilly very firmly segregated her house into work spaces and leisure spaces (Figure 5.3). Rosselin (1999) in her study of Parisian homes found that people like to segregate space, she gives the example of the apartment of a young student which had no hallway, the student had put a carpet of one square meter on the floor, to suggest a hallway, where guests had to leave their shoes, therefore making what was one space, the living room, into two spaces, the hallway and living room. A similar finding was made by this study. Simon Smith, when asked about the layout of his room and what he would like to change, commented that he would like to rearrange some of his technologies. The result of this rearrangement would be to turn what was a blurred space into two distinct spaces, one being leisure and the other work. It would seem, therefore that people can quite easily designate this two foot by three foot area as a work area and decided that leisure activities will, therefore, not appropriate for this space.

This lack of space should be of interest to designers because as Kaufman (1996) noted, the lack of physical space in the home is important, she pointed out that in Japan they have limited space, this has meant that devices produced in Japan have fitted easily into America homes, however, she has found that the reverse is not true. Therefore when thinking about work devices for the home or devices which can be used in multiple environments it is still important for designers to appreciate the limitations of available space.

Time and space

Problems arise when spaces have different meanings at different times. In the case of Robert Cook he associates a space in his home (corner of dining room with PC etc) as a work space. However, his children associate it as an entertainment space. In a more subtle instance the use of technologies changed depending on who was present in the space e.g. Barbara tended not to watch television when the other members of the family were not present and did in fact listen to the radio instead (Figure 5.6). These findings agree with the findings of O'Brien and Rodden (1999) they found that the meaning or use of a space was dependent on the time of day or the person inhabiting it. This time-zoning was also found by Munro and Madigan (1999). They found that the living room was effectively time zoned in that children had priority in the early part of the evening, but adults had priority later on. In this way, the same physical space can be made more flexible by the social norms that structure the way it is used. Barbara's comment that she is quite happy to watch television as a collective experience was also found by

Munro and Madigan (1999). It is interesting that in this instance instead of television being seen as a social isolator or a distraction, for family togetherness, it was instead used as a facilitator of family togetherness.

Designers should be aware that adding interactive services to a certain device may upset this time zoning or collective use of space as a consequence some of the interactive services/facilities may not be used as they may disrupt this harmony.

Control of Space

Feelings of control or lack-of control were found to be an important indicator of the participants' feelings towards their home space and the technologies within it. This issue came out in surprising ways, for example, Agnes commented that she

was unhappy with the way in which the housing association decided, without consultation, to place sockets in her kitchen (Figure 5.3) This inappropriate placement of sockets, meant that Agnes had to change the positioning of the devices in the kitchen so as to facilitate the sockets rather than herself. Both of the families who lived in rented homes were not happy with the layout of their kitchens (Figures 5.3 and 5.4) The kitchen in these homes had limited or no personalisation, this was in sharp comparison to the other families in the study who owned their homes and had personalised the kitchens to suit their needs.

This lack of personalisation was also found by Miller (1987) when he undertook a study of public-sector tenants homes. This could mean that our feelings of ownership of space could be dictated by the control that actually owning the property brings us. A study undertaken by Dolan (1999) of a right to buy scheme on a former public-sector estate, found that people were very excited by the prospect of being able to decide for themselves how their homes would look and that sometimes the new owner was overwhelmed by this new found freedom. Csikszentmihalyi and Rochberg-Halton (1981) reported in their study that when elders were moved from their own homes into sheltered housing they wanted to bring their furniture and objects with them. However, this caused problems as the apartments were smaller than the elders previous homes. The U.S. Government only viewed the furniture and objects from a utilitarian perspective and did not take into consideration the cultural connotations of the objects. By doing this they missed the importance of the objects as a means of establishing a sense of personal continuity and meaning in an otherwise new impersonal environment. Therefore if the studies undertaken by this research, and others mentioned in Chapter 2, are correct then feelings of non-ownership of space will affect how people feel and relate to their environment. This is indeed what seems to have happened to Agnes and the Smiths. As a consequence they have been unable or unwilling to implement change or to have a sense of control over their own space.

Other family members control over their own space also mediates the use of a technology. For example, Simon has control over his private space (his bedroom) in the Smith home, this has limited his mother access to the family PC because she does not want to invade her sons private space. Designers should, therefore by

aware that the space a technology inhabits will affect who has ultimate control over the device and who will mediate its use.

Place

Far from placement being haphazard in the home the placement of devices is well thought out and is often decided upon even before an artefact is acquired. Placement was found to be of prime importance to the use of a device. The choices or lack of them (sockets, aerials) which dictated that placement also had a profound affect on its use. The first finding was that some devices are placed in the same position as the devices they replace (Figure: 5.4).

This had an important affect on its subsequent use, in that it was used in exactly the same way as the original device (Figure 5.4). The Suttons (Figure 5.1), in particular, had very well thought out and relevant reason as to why their television was placed were it was. Could such a scenario be replicated in a laboratory setting? Kjaer et al., (2000) found that people placed a new television where they wanted in their homes, even though this meant that some of the functions, such as the ability of the television to swivel, were lost. During the technology tour families would mention why devices had been situated in the positions they had, for example, the fact a device had been repositioned because of the loss of a remote control (Figure 5.4). This finding suggests that designers should think about were the device they are creating would be placed in a concrete way as people are willing to loose functionality to ensure that a device is placed in the correct position for them.

7.3.9 Conclusion

This section outlined the findings from the participants current use of technologies in their home and speculated on how and in what ways this situation could be improved by designers. The themes highlighted important issues that should inform designers about peoples relationships with their technology in the home e.g. how we go about learning to use a new technology in the home, the different use and views held about spaces in the home. The next section will report on the issues that emerged from the data as being important for the future use of technology in the home.

7.4 The future use of technology in the home

This section reports on the design issues that may affect our future use of technology in the home. These issues arose from the data analysis of the transcripts, and the designs and redesigns of the participants envisioned devices. The same themes were uncovered as in section 7.3, however three additional themes were found: automation, mobility and personalisation.

7.4.1 Control

The issue of parental control was raised over the universal remote. Upon showing the device to a family, many issues were raised about control e.g. the mother wanted control over the children's remotes, and the father wanted to have a 'master' remote control. Another issue raised about control was the complex ways in which this would need to be handled in the future with different device paradigms. For example the following question was raised over Mike Smith's device (Figure 6.1): what would happen if someone orders the device to fill a bath when someone is in it? Who has control: the person in the bath? Or the current user of the device?

The automatic switching of modes which gave control to the machine was also seen as problematic(Agnes Reilly's device, Figure 6.10). Some of the participants would find a device automatically switching modes annoying.

Gordon and Catherine were concerned about what some of the devices implied about control when the user wasn't present. For example, in the case of Sue's cleaning robot (Figures 6.9) that this device may become out of control and carry out tasks the owner was unaware of when the owner was not present. This for them was a nightmare scenario in which the robot was in control rather than the user.

Emily's point (Figure 5.13) that the use of voice interaction could potentially cause arguments is of relevance to any manufacturer or designer thinking of implementing this type of technology in the home, as control over a device in the home can be critical to that device's use. As Morley (1986) pointed out, who has control over the remote control for a television can influence greatly what type of programmes are watched. The technology is not yet robust enough to either fulfil

the ease of use envisaged by the families nor does it have the flexibility to anticipate problems over control.

These findings also raise the point that control issues are quite different with families as compared to single people or couples, not in a straightforward way but in a quite complex way as demonstrated with Catherine's remote e.g. Sue wanted an override over the children's remotes, whereas the father wanted control over everyone's remotes.

In conclusion designers should be aware when building a device that control over a device has a major affect on its use. The home workshops show that people are able to articulate possible areas of conflict over control even at very early stages of the design process.

7.4.2 Cost

The comments on the running costs of devices were not limited to currently available devices but also a clearly articulated concern when asked for comments about future devices i.e. many of the participants made comments about the cost of running a future device as an issue when considering acquiring one.

Putting nearly all the costs onto the running cost of a device has been a strategy employed by manufacturers for many years. This strategy has proved, recently to be more risky than was once thought as mobile phone manufacturers and digital television companies have found i.e. people have not utilised accessing the web from their mobile phones, and people are not using the interactive services on their digital televisions. Manufacturers may think, therefore, that they will benefit by under emphasising costs, and this may certainly lead to people purchasing the item in the short term, the consequence of this may be that people stop using the equipment or service in the long-term. These findings take on particular importance if manufacturers are serious about wanting users to use interactive services on different devices.

Another consequence of not informing or clearly stating running costs was shown in finding in workshop one that the Sutton's said that they had both had positive experiences of the internet. when they had been able to access information quickly and effectively. They both agreed that they would have the internet if it was free. One of the main concerns voiced by this couple was that they did not know about

the running costs of the internet. Is this then a problem with adoption of technologies such as the internet, e.g. running costs. Is it that our senior citizens don't have enough money? Or is it that no-one has informed them how it works and how it is paid for, so that they can make a judgement? The elderly were found to adopt innovation when the technology met their needs and the benefits of using it were effectively communicated (Dunphy and Herbig, 1995). It may be that manufacturers at the moment are not effectively communicating costs either to the young (Gordon Petric) or to the old (Peter Sutton).

7.4.3 Interaction

When designing their own devices the participants highlighted that they wanted interaction in the future to be more: fun, enjoyable, and entertaining. For example, in Catherine's case she wanted people to be able to choose different modes of interaction which would make the use of the device more fun, such as using a tracker ball (these are generally associated with PCs and games consoles). Others thought through their interaction and wanted to be able to choose different modes of interaction depending on the circumstances e.g. touch, talk, pointing device, keyboard or a remote device. All the participants seemed very open to different and new ways of interacting with devices. Some of the participants had thought through the limitations of their choice of interaction e.g. Catherine realising that there were a limited number of possible buttons on an average remote (Figure 6.1) and think of ingenious ways around this problem. Others had thought of the different ways of cueing people e.g. Peter and Gordon wanted audio and visual cues to alert users if something was happening (Figures 6.2 and 6.4). One participant wanted her device to be so well laid out that the user did not even have to look at the device itself (Figure: 6.5).

This suggests that designers should be aware that people in their homes want new and interesting ways of interacting with their devices which are more fun. There are some interactive devices and services available at the moment, however it would seem that people are not always willing to have interaction dictated to them by us (designers) or manufacturers. An example of this is the use of interactive service on digital television, even though some of the interactive services are free, 80% of digital television owners said that they never used them (Towler, 2001). This research also found this to be true in the case of the Smiths and their use of

their digital television. Therefore, it is not enough to produce and sell an interactive product to ensure the use of its interactive functions and services. Learning about how users do or do not want to interact with their devices may help to bring about increased use.

Voice was cited as a possible mode of interaction, but as Emily Sutton pointed out this way of interacting with our devices could cause arguments(Figure 5.15). In contrast some of the families were aware of there being voice activation technology, and seemed to have a generally favourable attitude towards it. Eggen et al (2002) in their studies in the home also found that people were favourable towards the concept of voice interaction. This welcome from householders however should be tempered as they could be under the impression that they could just freely talk to the machine (as see in many science fiction television programmes, such as Star Trek and Red Dwarf).

7.4.4 Learning

The participants when envisioning devices tried to make learning more interactive and fun in the home environment. For example, Gordon's recipe device (Figure: 6.2) would teach users how to cook, and this teaching would be aided by more fun and interactive stimulus, such as auditory and visual clues.

When shown future devices participants tried to understand them by comparing the different functions to the functions available now on their current devices. This way of learning has its advantages e.g. users learn to use the new system, and its disadvantages e.g. users may only use the new system in the same way as they used the old.

Some people in the home like to learn by doing and want devices to be intuitive and support this type of learning and interaction. If this type of learning is not supported their users may complain of the same problem as this Lisa computer user: '*I want to do something, not learn how to do everything.*' (Carroll and Muzmar, 1986, p39).

Designers should therefore take into account that in the home more than one person may use a device and tailor learning accordingly e.g. age group or time starved. They should also give users the option to have different levels of learning e.g. a quick tour of the systems functions or a full induction session otherwise as

was demonstrated by the findings here and in section 7.3.4 the following will happen: everyone in a family, except the person who set the system up, will not be able to use the device (Figure 5.8) and people may use the new device in exactly the same way as their old one (Figure 5.4).

7.4.5 Lifecycle

The different stages in a devices lifecycle were found to have an affect on it's use and how it was viewed by the participants. Additionally the participants stage in their lifecycle made a difference to how they viewed devices.

Device

Issues about lifecycle were raised during the future devices discussion, one of the participants expressed the opinion that future devices were bound to crash at some point. The issue of devices crashing or being broken was again highlighted during the critique stage by Sue Cook. In the design session Robert Cook realised that gardens change over time and that the device would have to be able to be reprogrammed or adaptable to this. Some devices may also bring maintenance issues during their lifecycle e.g. the Robots with their moving parts that may need oiled, the lawnmower may need recharged and emptied. Even the owning of such devices would in all probability use up more of the owners free time, as the more good's one owns means less free time due to the devices requiring time for their maintenance (Linder, 1970).

Participants

The designs also reflected some aspects of the persons life stage e.g. with Peter wanting different cues from his device because of his infirmity and forgetfulness, and Simon thinking about a device which would fit into the space he currently occupies in his room at home. In two of the devices designed by the participants both an adult (Gordon) and an Elder (Agnes) both expressed the requirement for their device to be updateable by them. They did not in fact see the devices as 'finished' when they received them but rather as evolving and having a lifecycle of their own. This on-going evolution of a device in the home was also pointed out by Sturesson (2000); and Du Gay (1997) (see section 2.7). The issue for design in this theme is that:

- users are aware that devices need maintenance, however, they would like only to have to undertake minimal maintenance and to be able to carry out this maintenance as quickly and efficiently as possible, with instructions being available on the device itself.
- in terms of systems failure the participants were aware of the possibility of devices crashing, this was something that while problematic did not seem in of itself to be a of particular concern. However, the ability to quickly assess what maintenance, or why the device has crashed and to rectify this situation, if possible, is something that the participants wanted to be able to do. The participants quickly became frustrated with devices that could not be maintained easily.
- people want to be able to update their own devices. If they are not able to update their own devices it is envisaged that the device could have a shorter lifecycle as a result.

7.4.6 Privacy

When talking about future devices and indeed the future of home technologies the issue of privacy seemed to revolve around two questions: what information would you be giving away? what benefits would you derive if you allowed this access? Mike Smith commented that nothing would be private in the future (Figure 5.12). One participant thought that having interactive devices in your home would automatically lead to less privacy, it is interesting to note, however, that he did not see this as a problem.

In the design stage the privacy issue seemed to be elucidated by two of the participants wanting to know more about what was going on in their own homes and who was in them when they weren't there (Figures 6.3 and 6.4). The concept of security spanned further than the security of the home from burglars, but also encompassed other family members and the emergency services. Home monitoring is a possible theme for future development in the home. It would seem that people may be willing to give up their privacy in order to gain tangible benefits. Designers should be aware, therefore, that people are not always naive and understand that information about them is probably being collected (see O'Brien et al., 1999 and Mike Smiths comments Figure 5.12), therefore, rather

than hide this aspect from users it would seem a much more reasonable step to take to be open about this aspect of the device. Some researchers have even suggested that people may benefit in unanticipated ways from linking up homes and private spaces, for example, Blythe, Monk and Park (2002). They suggested that social connections, which have been lost over time, could be reactivated by using local on-line street maps that would help householders to keep in touch with their local surroundings, and chat with neighbours, this benefit was also suggested by Peter Sutton (Figure 6.4).

7.4.7 Utility

During the future devices discussion some of the families commented that they thought that some of the concepts behind the proposed future technologies may impede the utility of the device e.g. that it would be laborious typing out an email on a television remote. Need was an important issue in the future devices and critique discussions. The participants would comment on whether or not there was a 'need' for a device. They would comment that the devices they had at the moment were adequate for the tasks they wanted done, therefore, there was no requirement for a new device. Some devices offered to undertake tasks that the participants thought they carried out more than adequately themselves (Figure 5.12). When the participants commented that they could not see a need for a device they tended to be disinterested in the device.

When considering the future devices all the participants who carried out the household shopping did not think that online shopping was something that they would like to do. In fact one of the participants pointed out that she enjoyed shopping and made time for it, her comments about her shopping trips made them sound more like a leisure pursuit than a task (this would agree with the past research reported in Section: 2.8.1). Another participant commented that she did not think that supermarkets would deliver to someone such as herself (single elderly) who only requires small amount of shopping. What happens when designers incorporate into a device the ability to carry out a task or activity in a fundamentally different way? What are peoples attitudes towards this change? Perhaps the manufacturers thought that by incorporating explicitly, into what could be termed as 'white goods', the ability to shop they were encouraging home shopping. It is, therefore interesting that none of the households in this study wanted to carry out their shopping online. When manufacturers and super markets

give people the ability to shop on line are we and they forgetting about what happens to what we replace? Shopping is seen as a leisure pursuit and a way of getting out of the house. Since it is women who mainly shop, and who shop together, are manufacturers, super markets and designers, actually obliterating a social past-time?

This finding suggests that it is as essential in the home, as it is in the workplace, to talk to users about current practice, so as to gain a better understanding of the task being replaced so as to build more useable systems. Or indeed to find out if their is a 'need' for the task(s) to be taken over at all.

Future 'Need'

When talking to one of the participants about future devices she commented on how she thought the use of phones would evolve in the future and that no-one would have a land line in their home. If this turned out to be true what would the implications be for the design of phones? At the moment our home phones look quite different from our mobile phones. Is this preference for mobile phones primarily because of their mobility or does it have more to do with the fun interactive features and design? Some designers are studying how we use phones in the home at the moment. However, they are not comparing our different phones but only our use of our land line or mobile phone separately perhaps designers should be comparing these two technologies together to see what people in their homes may want from future communications technologies. For example one of the participants had an interesting future use vision of emailing her son via the Electrolux fridge while he is at college. As emailing is not something she does at the moment either through the families home PC or Television. It would seem, and this is just one possible interpretation, that she is more comfortable with the idea of emailing her son via a fridge than via a PC or Television. One reason could perhaps be due to her familiarity with fridges as apposed to PC's.

The implications for design are that:

- users can envisage changes for the future use of a device(s); and
- that they can think of uses for a device which may arise in the future, but are not required at the present time.

This is an interesting contribution to how we approach users with ideas for design i.e. that designers or researchers do not have to limit themselves to discussing what users currently want or use. This way of orientating users to future possibilities was in fact the intention of showing the future devices and was inspired by the ideas put forward by Ehn and Kyng (1991) of showing people prototypes to orientate them towards the future.

Functions

During the redesign many participants added new functions to designs (Figures: 6.25 and 6.34) sometimes this was to suit their needs (Robert) or to suit perhaps the perceived needs of the user. Some of the participants added extra functions even though some of them, for example Sue, knew that this may not be the best way to improve the design. Some of the designs as a consequence became very feature laden. The adding of additional functions can be problematic for designers of technology as well, as some will claim that people will only buy the latest device with the latest functions. However, additional functionality can also be added as a way of improving a device as can be seen by Dianne Cook's redesign of Robert Cook device. The participants were willing to explore and discuss the functionality on existing devices, future devices, and their own designs and others ideas for devices.

This may be a way for designers to explore functions they have added to devices by asking participants in the home to add or delete functions that they think are inappropriate. This is something that has been proven to be successful in participatory design, as exemplified by Ehn and Kyng (1991) and Muller (1991), and the information gained from the participants in the workshops would lead one to believe that it would also be successful in the home. However, one would have to say from these results that designers need to be wary of users who will add functions to suit themselves rather than to improve the design.

7.4.8 Space and Place

The participants could clearly articulate whether a device would or would not be adopted into the home dependent on whether or not there was an appropriate space/place for it. The participants had a clear idea of where a device would be placed before a device was acquired or even existed in actuality.

In the future devices discussion the participants thought of places for the devices they were shown and could articulate exactly where they should be placed. The positions were not haphazard but logical well thought out positions for these devices e.g. away from excessive heat or water.

When envisioning new devices for the home the participants thought that placement was important. For example participants had very clear ideas about where their devices should be placed and even demonstrated their envisioned device in their preferred location. In the critique stage it was found that when a participant thought that a proposed design could affect the layout of the home, this seemed to provoke unease. Also each participant viewed the device and the functions on the devices as appropriate/not appropriate depending on where they imagined it would be placed. This helped Gordon, who was critiquing the device, to elucidate a problem not foreseen by Simon, the designer (Figure 6.23).

In the redesign of Agnes Reilly's device Catherine and Dianne had envisaged that the device would be placed in a living room, and redesigned the device in an appropriate way for that context, however, Agnes had not envisaged placement of her device being in the living room, therefore, some of the extra functions added by Dianne and Catherine would be suitable for a living room context, but perhaps not for a Kitchen

When the workshops were being set up the importance of space was known but the importance of place was not as well known. The placement of the device had an affect on its size and functionality when the participants were designing it. What happened when that device was shown to others was that they then envisaged a place for it in their home and changed it accordingly, even though this may not have improved the device functionally.

Designers need to be aware of the issues surrounding placement of a device and what affect this has on use. Indeed as pointed out by Peter (Figure 6.4) if the device is too far away he will not use it. Therefore thought should be given by designers as to whether flexibility of placement should be built into the device or be left for people to arrange on an add-hoc basis (re: recipe device). Placement in the home is not haphazard and placement is more complex than allocating an object a physical space, it also encompasses the appropriateness of the functions,

the users understanding of the device and has a profound affect on what functions are used or not used.

In conclusion close attention and thought should be given to where a device is going to be located if the designer wants the full functionality of a device to be used.

Lack of Space

Lack of space was also found to be important in the home. People would express a wish for a multi-functional device because it meant that it would free-up space, for example, Simon Smith wanting the HIC (Figure 5.13) because he lacked space in his current bedroom and Gordon and Catherine wanted it because they thought it would be better than having separate devices. From a usability and user interaction perspective it would seem that people will choose a device, not because it is aesthetically pleasing or entertaining, but for more utilitarian purposes e.g. to save them; space, from having to have separate devices and from having to acquire an additional device e.g. Therefore Kling's comment that families when thinking about acquiring a device do so on the basis of utilitarian purposes (Kling, 1980) seems to hold true even when asking families about future devices.

In the critique session some of the participants said that there was no space for a particular device to go and therefore they would not want the device. Dupagne and Agostino (1991) found that space is becoming an important constraint on consumer behaviour. Their research on wide-screen television suggested that although a wide-screen television is best capable of demonstrating the benefits of enhanced picture quality, people failed to adopt it because they thought that the television would take up too much space.

7.4.9 Automation

More than half of the devices envisioned by participants included some level of automation of tasks in the home. Some of the participants welcomed mundane tasks being taken over in the home, while others thought that having some tasks carried out for us may make us more lazy, physically and mentally. The negative aspects to automation were particularly emphasised, by adults, when the device was taking over tasks from children.

Abowd and Mynatt (2000) when looking at the possibilities for future research in ubiquitous computing said that people may want computers that they wear, or have embedded in their environment, or they may wish to have information at their fingertips. During the studies the participants expressed, whilst talking about future possibilities, a wish for some devices to be embedded in their environment as can be seen by Peter's home warning device (Figure 6.4), and Mike's home controller (Figure 6.11). Ubiquitous computing is involved in looking at how we can change the physical interactions between humans and computers, instead of the current keyboard/mouse/display paradigm, in the future it will be more like the way we interact as humans with the physical world i.e. speech, gesture, touch, pen and pencil. It is evident from what the participants designed and said e.g. Mike wanting to talk to a device and ask it to run a bath for him, Catherine wanting her universal remote to work a myriad of devices, that they wish to have a device or system that they can talk to, or touch, or point/gesture at. Norman (1999) said that devices would disappear into everyday information appliances and this seems to be what these participants wanted. As Peter Sutton mentioned he only wanted to see the home control system when it was in active use and for it to disappear into the background behind a photograph of his family or a painting (Figure 6.4) when not in use. The way the participants were thinking about the home seems to be moving away from the current computer paradigm to a physical world paradigm of voice, touch, gesture.

Bad connotations

If a device undertakes tasks we normally do ourselves the participants thought that one result might be that we become more lazy. However, one of the devices was an automatic lawnmower (Figure 6.8) and some people do not enjoy mowing the lawn, therefore replacing this task with a machine that will do it automatically, does not on the surface seem to be a bad thing. Does having a device taking over mundane chores such as cleaning a bedroom, or mowing a lawn really make us more lazy? Or is it merely freeing up our time so that we can go and do something less boring instead?

Some of the participants tried to justify their choice of a future device or features of a design by saying that it was something a disabled person could use (Figure 6.12), instead of saying that what they wanted to do is save themselves the extra

time and effort required to carry out the task. Catherine commented, during the critique stage that she thinks a device will make her more lazy but she would still like to have it (Figure 6.16).

In the case of the robots designed by the children the adults seemed to be of the opinion that they may affect child development (Figures 6.23 and 6.24). For example, Gordon and Catherine were concerned about Dianne's concept of a robotic pet taking over from real pets as they thought that this could lead to social problems in the future. When is saving the user from doing a task a bad thing? Is it okay to get to the point where people do not have to take the time to nurture a pet? In Tarquin's case he wanted a robot to do all his tasks around the home, which were of a limited nature i.e. keeping his own room tidy and fetching things for people, in all probability he does not need a robot to carry out these tasks.

Some of the adults in the study opined that the robots (pet and friend) could cause the children not to have to make an effort to learn social skills or responsibility. It could be argued, and has been, that watching television, which is often a solitary experience, may cause damage to social skills (Csikszentmihalyi and Rochberg-Halton, 1981). However other researchers have argued that if designed carefully a robotic 'friend' or 'animal' may present a unique opportunity to teach children appropriate emotional and social-cognitive skills and interactions (Strommen, 2000).

The findings from this theme suggest that people in their homes are quite happy, after expressing appropriate well mannered comments as to laziness, to think of and express a wish for a device that would save them from doing mundane tasks in the home. However, this is only when it frees up adults from undertaking mundane tasks!

7.4.10 Mobility

Wireless devices that allow people to move devices through their homes were welcomed for the home and gave rise to discussions about the ability to place a device anywhere the person wanted in their home and how it would help them free up currently tied up space. In fact some of the participants incorporated this idea into their designs.

Wireless technology offers people the opportunity to have their devices wherever they wish without having to worry about sockets, something which was found to be an issue with the participants, and had an affect on how people laid out rooms. Therefore, it could be envisaged that the ability to move devices from room to room without worrying about wires could cause a fundamental change in the way we use devices, layout our homes, and organise space.

7.4.11 Personalisation (aesthetics)

The background research had highlighted how aspects of personalisation and aesthetics where important features of a device. Interaction designers want their devices to be: entertaining, fun, aesthetically pleasing, etc (Preece et al., 2002). Neilson (1993) highlighted 'subjectively pleasing' as a goal of any system. Further studies by Csikszentmihalyi and Rochberg-Halton (1981) found that personalisation of some kind was of prime importance to peoples feelings towards their artefacts. However personalisation is a contentious issue, as one persons concept of appropriate personalisation can be in stark contrast to someone else's. It was anticipated, therefore that personalisation would be an issue raised at the home workshop sessions. However what was unclear was whether any data gathered would be able to give designers any fruitful information about the personalisation or aesthetics of home devices.

The first finding about personalisation was that the participants wanted to give users some control over the personalisation of a device, for example Catherine wanted people to be able to choose different covers and interaction modes for their universal remotes. In Dianne's redesign of the automatic lawnmower, she wanted people to be able to choose from a range of colours. It could be claimed that by giving the user more control over the personalisation of their devices many interaction goals such as fun, enjoyable, entertaining, satisfying, aesthetically pleasing, and motivating, would be met. Peter, wanted people to be able to project their own art or picture on his concept for the home, so that the device itself would disappear into the background. Designers are trying to make the device aesthetically pleasing but what Peter wanted was not to see the device at all. This finding should perhaps act as an incentive to designers to include people in the design of technologies or future concepts for the home.

One of the problems with personalisation arose during the critique phase, in that some of the participants fixed on the colour of the device even if they were told that the colour was not fixed and that the colour was only an example, some of the participants still disliked a device because of the colour (Catherine's universal remote: Robert and Tarquin).

In one of the more unusual twists during the critique stage, Gordon comments on changes to Roberts device would make the device more like a pet than a machine. This is an interesting point for personalisation and design i.e. where do machines end and living things begin in our imagination when people start thinking of a lawn mower in this sense?

A different way of looking at personalisation was provided by Gordon. Gordon thought that people should be able to pick and choose the components of a device depending on their wishes and family paradigm. He commented that while one of the device's had many worthwhile functions (Figure 6.13) it was perhaps too overloaded with functionality and that this might cause problems if different members of a household wanted to use the device at the same time. His solution to this problem was that you could have a main unit that all the devices could be plugged into and serve as a base for the different parts of the device. This would mean that any member of the family who wanted to use a particular part of the device could either use it in situ or take it away to be used elsewhere. This solution harks back to a time when a stereo system with half a dozen major components (i.e. receiver, amplifier, speakers, turntable, tape-deck and cartridge), manufactured by dozens of companies in dozens of styles, could be assembled in many different ways, giving ample opportunity, even modestly, for choosing a system that no one else had. When users were allowed to do this with stereos, in the past, it was found that the users thought that they were the most special objects in the home (Csikszentmihalyi, and Rochberg-Halton, 1981).

This is obviously a larger issue than it was possible to cover in these workshops, but is a fruitful one, or perhaps one could say a challenge for design i.e. in what ways can we give users the ability to personalise their own devices? In conclusion the participants seem happy to leave the majority of the design decisions, even the aesthetic ones in the hands of the designer.

7.4.12 Conclusion

This section drew conclusions from what the participants said they wanted for the future in the shape of their designs and comments. Three new themes were introduced that had not been found by the investigation into the participants current use of technology. Suggestions from these conclusions for designers were provided.

7.5 The Effectiveness of the Home Workshop Method

This section will attempt to assess whether one of the main contributions of this work has been met by the home workshops. The contribution, see section 1.3, was to provide a method that would facilitate requirements-gathering in the home with a heterogeneous group of users and inform designers and researchers how better to undertake a study in this environment. Each technique used in the Home Workshop will be assessed in two ways: firstly was it effective i.e. did all the participants engage with the technique and make contributions, secondly did it provide data that would provide information about our use of technology in the home, and would the data provide designers with general principles.

7.5.1 Technology Tour

The Technology Tour focused on current technology and the participants relationship with this technology. This session was seen as an opportunity for the researcher to learn about the household and the technology contained within it. The main thrust of the technology tour revolves around four key issues:

- what technology is present in each room
- where is it placed
- who uses the technology
- how is it used

The technology tours answered these questions and a rich set of data was collected as a consequence, as can be seen by the models in Chapter 5. The technology tours were typically quite unstructured with members of the family coming and going, commenting and cutting in as appropriate. Although this led to some difficulty in the analysis, it was certainly grounded in the situation! The participants were asked about the use of their technologies. This prompting produced some particularly interesting accounts, focusing on specific incidents and breakdowns. The participants also told stories about their past use of a

technology and these stories are valuable in that they are repositories of accumulated wisdom (Brown, 1996) and provide accounts of the social, physical and technological space of the situation (Venkatesh, 1996). By asking the families to tell the researcher about all the technologies they owned the researcher discovered that some of the most interesting technologies were the ones that where not visible, for instance, a new games console which had internet access that had been stored in a cupboard.

When inspecting or conducting a tour of people's home space it is important to remember that people and especially women expect to be judged on the cleanliness and order of their home (Munro and Madigan, 1999). There can also be conflict between the public, respectable face of the home and the desire to create a relaxed 'back region', this aspect was found in the technology tour. For example in some of the home the participants were happy to show ever nook and cranny of their home's, whereas in others access, was limited to public spaces. There did not seem to be any particular dictum behind this as the Suttons who had a home of a similar size to the Cooks i.e. large, with gardens to front and rear and spread out over more than one floor, had very different attitudes towards private and public space. Only two of the household who took part, made the decision not to allow access to the private areas of their homes. However, this did not seem to have a negative affect on the data gathered from these homes.

During the tour a participant said that he did not use any of the technologies in the kitchen, however, his wife, opened the fridge and pointed to a home made dessert and made it quite clear from her inferences that he has made the dessert himself. However, she did not go as far as to actually contradict his statement. In the past sociological studies (Livingstone, 1992) researchers have interviewed couples separately, and also not in the same room as the devices, in these studies men have claimed that they do not use the technologies in the kitchen, however, there are grounds for questioning this finding. As the above finding shows we cannot always be certain that people are telling the complete truth and may as a result miss interesting insights into the use of a technology if we interview users separately and away from the devices. The tour provided many insights which have been highlighted in the previous two sections.

7.5.2 Future Devices

This part of workshop one seemed to work quite well as it orientated the participants towards ideas for the future. Further it also encouraged the participants to think about where they would place such a device, how often they would use it and what for. Some of the future devices provoked laughter such as the smart fridge and this led to further discussions about the practicality of some of the future devices. The participants seem quite happy to carry on discussions about devices that only existed on paper.

It was interesting to try and gauge what exactly it was in each device that the participants found engaging. In one particular instance a couple (Smiths) argued over which of the future devices was best and in fact the husband tried to get his wife to change her choice of device to his! It was interesting that people took ownership of these devices quite quickly. As suggested by Ehn and Kyng (1991) and Bannon (1991) showing participants paper representations of future devices can orientate them towards envisioning future possibilities. They were also fun to work with as they provoked laughter in some instances, which led to a more relaxed atmosphere. They did indeed, as suggested by Buur and BØdker (2000) become props in a collaborative attempt to discover essentials of use situations which may evolve in the future.

7.5.3 Scenarios

When working through the scenarios, two of the participants were prompted by them to re-think the way they currently undertook a task. This manifested itself in two ways. Firstly Barbara commented about the different possible ways of interacting with different modes on a phone when trying to contact guests. Secondly, it prompted Gordon to voice dissatisfaction with the way he carried out preparing a meal at the moment and how an interactive recipe device may make this task more enjoyable. Even though there were these benefits, overall the participants failed to engage fully with the idea of the scenarios. The participants seemed uneasy about what exactly was expected of them and, therefore, had to be prompted regularly. This was not something that happened at any other point during the workshop.

The scenarios did work to the extent that they confirmed what technologies the participants used at the moment to undertake certain tasks. This is an important

point in that knowing what people use in the home at the moment can still inform research, for example Harper et al. (2002) found in a study of paper based mail in the home, that some of the affordances of paper mail could not be easily replicated in an email system at the moment and, therefore, the potential of email to take over paper mail in the short-term was not high.

7.5.4 Inter-session Activities: Post-it™ Notes

Post-it notes were used to collect data in between the first and second session. The post-its in this instance were not completely successful, this was because the post-its given to the participants proved to be too small! An example of when the post-its worked successfully was when the researcher returned for the second workshop session. The first session with Mrs Reilly had been extremely difficult as she lived on her own and their was no-one else to join in the conversation. However, on returning for the next session the researcher found that Mrs Reilly had been very active writing post-its, she had been busy thinking about the future devices and other issues that had been raised in the first session. An example of how Mrs Reilly had used the post-its is shown below, she had attached post-its to one of the future devices, the interactive microwave by NCR (See Figure 7.1).

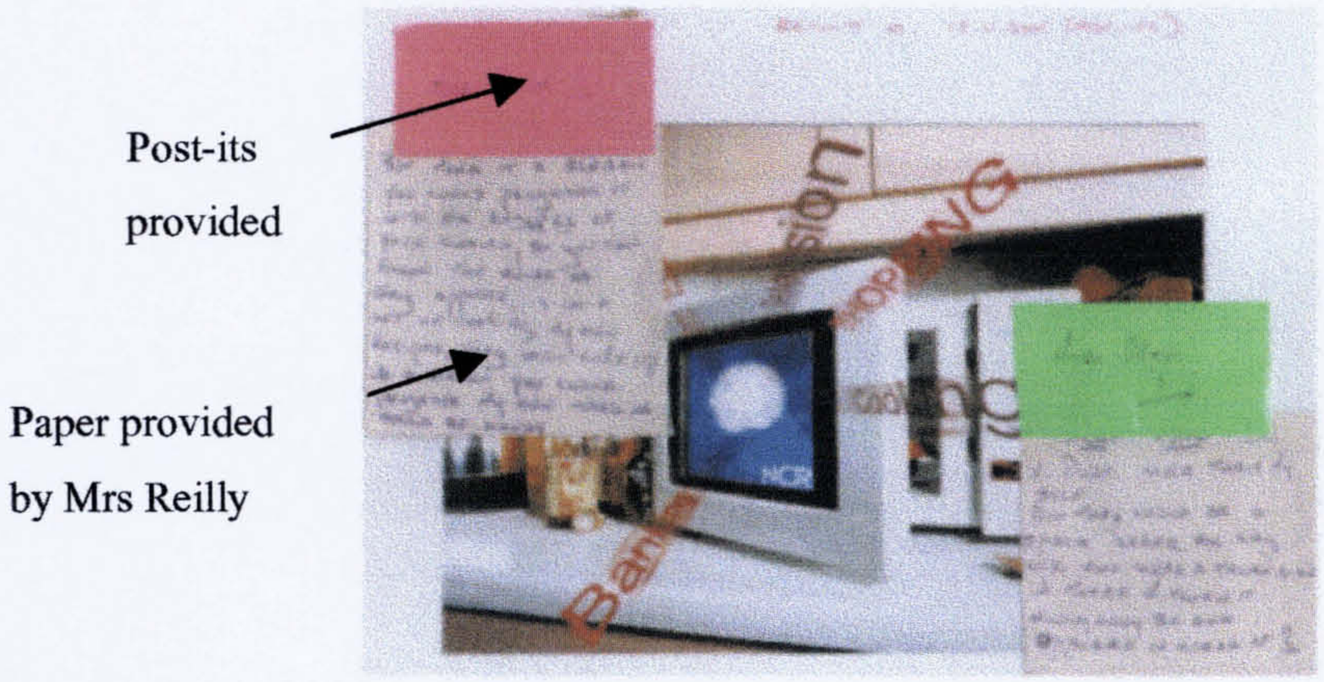


Figure 7.1. A. Reilly Post-its™ (Reilly2: A1)

The post-its provided were inadequate and Mrs Reilly had to provide her own as can be seen in the above figure.

The post-its could not be analysed in a meaningful way as some of the data was on drawings, or trailed off when there was not enough room to continue writing. Twenty-two post-its were collected in all, this however included post-its where the writing had continued onto a piece of paper or onto the picture/drawing of the

device itself. Of the post-its that had been filled in, some people had recorded the extra facilities they would like from the device on post-its, others had annotated an actual device or a picture of a future device. It could be concluded therefore that if the post-its provided had been of an adequate size they would have proved to be an effective method of gathering data between visits.

7.5.5 Designs

It was anticipated that by asking participants to envision their own technology more would be learned about what people want, or do not want, from home technology in the future. It was further hoped that this would encourage the participants to think of their own solutions to current problems and envisage some novel ideas for designs of home technologies.

We as researchers are sometimes guilty of feeling that people cannot articulate their ideas for the future without help from us. We can also sometimes assume that they cannot envisage novel solutions or ideas for the future. During the course of the workshop design session it became clear that people, of various ages, could indeed envisage novel ideas for future homes/devices, if not practical at the present time. The devices designed by the participants were never intended to be seen as finished designs but were in fact intended to be seen as visualisations of possible future homes or devices that the participants wished they could have.

Demonstrating the design

When demonstrating their designs the participants would gesture, mime, and go to where they envisaged the design being placed. The locations chosen by the participants for their designs were very practical i.e. easy access to plug sockets, away from excess water, and so on. People when demonstrating their device also thought about how the current space, that they were thinking of placing it in was used for at the moment.

Practical Problems

The main difficulty with this session and in fact the redesign session was that unlike a work setting, or a setting the researcher has control over, you could not dictate the layout of the room before hand. This caused some problems when asking the participants to draw their own designs and redesigns as all of the rooms, bar one, did not possess a table for the families to draw on. This meant that the families had to: lean on books, kneel down next to coffee tables, draw on a

space on the floor, or draw leaning on a book while sitting on a chair. This perhaps led to fewer designs than would have been expected, as it could be quite uncomfortable, in some of these positions to draw. However, all the participants (bar one: Peter Sutton) drew at least one device and two participants drew two.

One of the first problems encountered with this session was the reluctance to draw or envisage a new device. This had two strands: the first was that some of the participants did not think their drawing skills were adequate; the second was that the participants did not think their ideas were good enough or original enough. This was a problem that ran throughout this session.

The fact that a device may already have existed albeit in a slightly different format was also brought up by the participants during the session, however, this was not seen as a problem because what was important was that participants visualise devices that they wanted for their home. It was not thought appropriate for the researcher to either ask the participant to envision another device, as this was not an issue for this research as any idea from a participant was thought to be a valid one. It was found that even though the participants may indeed have visualised a device, which was already available in some form, it was generally true that the device envisioned was not exactly the same as one available in the marketplace and that these differences were inherent to the device.

The osmosis of the designs

It was in some instances possible to see from the transcripts and video where ideas for devices had sprung from, for example, in the case of Simon, the limited space in his room could have influenced his design. Gordon working through the scenario of cooking in his kitchen and wandering back and forth from the kitchen to the living room while working through the scenario, Catherine gazing round her living room and seeing the various remotes in situ and Peter and Emily wanting devices that would help them in their old-age.

Design as an investigative method

A major criticism levelled at users and the main reason given for not including them in the actual design of devices for the future is that they cannot be innovative (Gaver et al.1999; Crampton-Smith, 2002; Ehn and Kyng, 1991; Bødker and Greenbaum, 1991). This work, however has gone some way towards showing that participants in the home can visualise quite stimulating ideas for the

home. The designs provided clues and indeed confirmation of what people wanted in their homes.

Conclusion

In conclusion the main issues to come from the design session were similar to the issues in the previous session this helped to concretise the themes e.g. personalisation, cost, lifecycle, interaction, spaces, placement, amongst others. Therefore the designs proved a rich source of data in of themselves because of the rich descriptions of their potential use in the home and the envisioned future interactions wanted by the participants.

7.5.6 Critique

The purpose of the critique was to learn about what the other families thought of each others' designs, which it was hoped would encourage them to think more about their own design, and to let them see how other families had designed. One of the issues of the critique stage was that sometimes the participants either had little or nothing to say about a device, or focused on one part of the device to the exclusivity of the rest of the device. This meant that some devices drew quite a number of suggestions and were thoroughly critiqued, in contrast, other devices attracted little or no comments.

Providing Solutions

When asking people to critique a design, they would sometimes start to redesign the device and discuss possible solutions to perceived problems. This was quite a common occurrence throughout the critique session. The participants did this most when they didn't like a device concept or part of a design concept e.g. Gordon re-designed Simon Smiths design because he thought it would be impractical in its present format, for use in the potentially multi-user context of the home. The participants also mention different stages in the lifecycle and how the device could potentially be used and maintained over time.

Favourable reactions

One of the more interesting points of note during the critique stage was that if a device evoked a favourable reaction from a participant this was usually the one they went on to redesign. It is interesting that, just from a rough sketch and short explanation of the concept behind a design, participants could quickly grasp not just the overall concept but also decide whether they felt favourably towards the

design, where it would be placed in the home and whether or not they would like a device of this sort.

Critique as an investigative method

This concept worked quite well. The participants seemed to feel quite happy about critiquing someone else's design. When formulating the Home Workshop sessions the idea of the final workshop being held as a group session was considered, so that the participants could more easily discuss and redesign the different designs in groups. It was decided, however, to locate the sessions as before in people's homes as it was felt that this would help ground any comments or redesigns in context.

On reflection it was indeed better to situate this session in participants' homes as the participants felt quite comfortable critiquing the other participants' designs. The participants may not have been so open in their criticism if the person who had drawn the design had been in the same room with them. The participants also spoke about how the other participants' designs could be used in their homes, this again is something that may not have happened if the session had taken place away from the home.

One exception to this open criticism was when the participants could see, from the drawings, that the designs had been created by children. Some of the participants commented that they felt uncomfortable critiquing, too strongly, designs by children. It was not possible to hide that fact that it was a child's drawing, therefore, researchers and designers should be aware that designs by children may be less commented on than other designs.

Other issues found by critique were that when a concept was found to be too dull or mundane the participants seemed to be uninterested in commenting on that design. Another was the possible misuse of a device. This was something voiced in particular about Tarquin's robot friend and Dianne's Amazing Pet. It is interesting to not, however, that no one thought that a cleaning robot could be misused in the same way. This could be because of the task based nature of Sue's robot maid as apposed to Tarquin's emphasis on his robot being a 'friend'.

Some of the participants compared their own devices with the other participants' designs. Some in fact went further and thought that their design idea could be

incorporated into one of the other participants' designs. The participants also compared the designs with the technologies they had in their homes. This shows that participants can compare concepts for devices against existing devices, others devices and future devices. This could bring into question Gaver's (1999) assumption that quite abstract concepts cannot be articulated to users. Perhaps designers would in fact benefit from showing users their designs at an earlier stage than has commonly been done in the past. The critique stage worked in that it fulfilled the premise on which it had been designed i.e. that it would inform the researcher about what the participants thought of each others designs, encourage participants to think again about their own designs and to think of the design being placed and used in their own home.

7.5.7 Redesign

The participants were asked to choose their favourite design and redesign it. The intention was to gather data about possible new functions and about the usability of the designs. Another area of interest was to see whether people could think of ways in which they could use this device in their own home.

Conduct of redesign session

The participants, in the main, redesigned the other participant's designs in very practical ways, for instance, Dianne Cook redesigned her father's automatic lawnmower, see Figure 6.27. Other re-designs were similar, e.g. adding functions, personalising the device, or making the design more usable. Perhaps any problems that may have arisen were alleviated by the participants being free to choose which design they wanted to redesign. This resulted in some of the devices being re-designed many times and others not at all. It, therefore, became obvious which of the designs where the favourites amongst the participants. Only one of the participants had difficulty redesigning another participants design, Mike Smith. In some cases the redesign did progress the concept of the device (Robert: Barbara recipe device; Dianne: Roberts lawnmower), however some of the suggestions were more interesting in the way that they highlighted other issues which had been raised in previous workshop sessions e.g. too many functions on one device, cost and the taking over of tasks.

Problems

Cramming too much functionality into one device was the main issue in the redesign session. Sometimes combining devices can work well e.g. a convection oven with a microwave, however, the success of this combining can depend not just on what is combined but the quality of the devices being combined. A reason for this function cramming may be that sometimes the participants forgot which designs had, which functions, it would, therefore have been helpful to have had a list of the main functions attached to the drawing of the design (this list should be approved by the participant designer) to help facilitate understanding.

When redesigning other peoples devices the participants took features from other participants designs and mixed and matched functions, for example, when Sue Cook was redesigning Simon Smith's device, she remembered information about Peter Sutton's and added a security device to the device.

It would seem that in this case the participant was just trying to cram as much functionality into one device as possible. Other participants also combined devices and functionality without thinking through the implications of these additions. However these participants are not alone in cramming multiple functions into a single device, this is a common criticism levelled at designers (Dholakia et al. 1996).

One issue with allowing the participants to choose whatever design they liked to redesign was that members of the same family would redesign the same device. For example, Barbara and her son picked the same design to redesign (Automatic lawnmower) this did not cause problems, as such, except that Barbara thought that some of her redesign ideas matched her sons. Perhaps family members could be encouraged to redesign separate devices to try and alleviate this minor problem.

Conclusion

The intention of asking the participants to redesign each others designs was to gather data about possible new functions and about the usability of the designs. Another area of interest was to see whether people could think of ways in which they could use this device in their home. The redesign did indeed encourage the participants to think about ways they could use these devices and what they could add to 'improve' them. However, the redesign phase seemed to suffer from a certain level of abstraction, what is meant by this is that the participants did not

always, unlike in the design session, attempt to situate their design in the context of their own homes. The devices just seemed to be re-designed for their own sake and little or no thought was expended on how the device would fit into the home, unlike in the other stages of the workshop. A way of improving this session might be for the researcher to ask the participants to think of their own home for a few moments and how this device could be redesigned to fit in with their lifestyles to orientate them more towards the context.

7.5.8 Analysis of the Data Collected from the Home Workshop

The sensitising concepts used to guide the coding e.g. usability goals and spaces were found to highlight most of the main issues emerging from the data. However, other codes emerged from the analysis which were found not to have been covered by these themes but had been found by other researchers, such as cost.

The main problems found with using video to collect the workshop data was the length of time it took to transcribe each tape in its entirety usually several days. The data once transcribed also needed to be analysed using the method discussed in section 7.2. This stage of the analysis took several months. The length of time taken was due to the researcher being naive in her knowledge of the time taken to view, transcribe and analyse video tapes and designs, something not unique to this researcher but has been found by other researchers as well (Bauresfield and Halgren, 1996). The analysis stage though long proved to be worthwhile as the themes that emerged gathered together in clusters the thoughts across the households. This clustering led to a greater understanding of the families use of technology and their relationship with it.

On a practical level there are two ways in which this rather long period of analysis could be cut down. The work could be undertaken by an experienced researcher or by a group of researchers. Secondly, if the research aims were not as broad and exploratory as this work's obviously were. There were also some problems knowing when it was appropriate to switch on the camera as some people liked to perform for the camera and others do not. Sometimes data or comments would be missed because the researcher was changing tapes or had switched of the video camera when going between rooms, therefore another recommendation would be that more than one researcher is present at each session, something that was not

possible during this work. Except for these minor problems video proved a valuable tool in aiding the collection of data in the home.

7.5.9 Conclusion

As can be seen from the above discussion each tool employed by the Home Workshop did work well as an investigative tool. The findings from the Home Workshop would have provided information to assist the Flex (see Section 1.1) project to answer some of its key questions e.g. where in the home should a device of this type be place, which in-put and output modes are appropriate for the home setting. The Home Workshop provided a rich set of data which would help any researcher or designer to know more about people's use of technology in their own homes. The Home Workshop was also successful in involving whole families in the research process, something that has been a problem in the past with more interview based studies. User-centered design and Participatory design tools and techniques provided a way of probing and elucidating how people currently use their technology and also assisted in aiding participants to envision possibilities for the future.

7.6 Other methods for Investigating the Home

Why would a researcher use this method rather than one of the other methods that have proven successful in home based studies? The reasons why this method may prove to be more appropriate for studies in the home is discussed in this section, each traditional method outlined in chapters two and three is compared to the home workshop method.

7.6.1 Ethnography

Many researchers have commented (Harper et al. 2002; Stewart, 2001; Hughes et al. 1998; O'Brien et al. 1999) that it would be difficult if not impossible for a researcher to conduct an ethnography in peoples homes in Britain, not only because of the nature of ethnography but because of the very nature of homes which would mean that because of the length of the study the researcher would begin to affect the behaviour of the household members. Therefore, other ways of conducting ethnographic field studies in the home have been found, for example, ethnographic interviews (Harper et al., 2002; O'Brien et al.,1999). These studies have been successful in finding out the social aspects surrounding technology or

artefacts in the home such as, mail and what makes them successful or unsuccessful in the home.

These studies however, only dealt with a single device or artefact and not all technologies in the home. What was learned from the first workshop was that it is not just what technologies or artefacts that are currently being used that is important, but also the presence of artefacts or devices that are not being used, which provide invaluable insights into peoples relationship with technologies. Further while the studies by Harper et al., and O'Brien et al., provided information about what people did not want to do with their technologies, they did not go as far as to tell us what they did. Designers of new technology need both sets of information to enable them to build more acceptable devices for the future.

7.6.2 Probes

The reason given for using probes from Gaver et al. (1999) was that they could help designers in their efforts to pursue ideas for experimental design. In their study it was unclear how the probes actually fed into this experimental design process, for example, the researchers said that they wanted to provoke inspirational responses, but the probe's postcards and photo requests were couched in the following terms: 'your home', 'what will you wear today'? It is unclear that these questions would provoke the inspirational responses wanted by the design team. It would seem that what the designers actually did with the probes was to try and understand the elders' view of their area. However, did the probes add any information the designers would not have received through existing methods such as interviews, ethnographic field studies, etc? Also did the probes gather better qualitative data or quantitative data than the more traditional methods? In essence did the probes work? The Oslo group (affluent community) returned nearly all the probes; A housing estate in Amsterdam (crime and drug ridden), and an Italian Village (beautiful and picturesque) less than half of the probes. The designs produced from this gathering of data are the most interesting part of this study; for the housing estate they designed Slogan furniture, which was displayed outside the high-rise apartment block for two weeks. The researchers hoped this would help to provoke awareness of the existing community to the inhabitants. While they found that the benches provoked interest from the community, they admitted that the fact that they were only there for two weeks was too short a time for them

to gather any meaningful results. The most that can be said about the slogan furniture was that it provoked a reaction, but would this reaction have been provoked by any piece of installation art? It is difficult to see how the bench affected or enhanced (even for a short while) the lives of the elders for which it is supposed they were built or indeed how they enhanced the areas sense of community.

The second design was the one built for, Majorstua (affluent area of Oslo), where the participants returned nearly all of the probes. The researchers proposed that the elders hold a community wide conversation from their local library the results of which would be displayed for public response in cafes, on trams, or a public space. It could be suggested that this is not a particularly inspired suggestion as libraries are already seen as places for people to meet and hold community discussions. The novel element would seem to reside in the idea of displaying the results. The lowest number of cultural probe returns came from Peccioli a Tuscan village. This area is described by the researchers as being: in a beautiful setting, with a relaxed social life. The designers came up with the following idea: '*Create social and pastoral landscapes, and create radio-scapes which would allow them to listen to the sounds of the surrounding countryside.*' (Gaver et al., 1999, p27). These villagers live in the countryside, they would only have to open a door or window to see the beautiful landscape and hear the associated sounds. This would seem like a massively technologically based solution to a non-existent problem because, as the probes pointed out, these people spent a lot of time outdoors and in cafes chatting to friends and neighbours.

Their probes did gather data but then so does a questionnaire, albeit in a more traditional and dull way. What these probes failed to provide, is one of the issues highlighted by the technology tour, in that it is not just the technology we have or the space that we inhabit it is the juxtaposition of them both i.e. the physical position and space that a technology inhabits that mediates our relationship with and our use of that technology. It could be suggested that probes in of themselves are not enough to enable designers to either design new technologies or involve users fully in the design process. The use of probes in the Home Workshop (future devices) did enable discussions about the future to take place and ideas for concepts for the home to be explored in situ.

The probes were tried out in the positions that the participant imagined them being as if they were physical objects. They also informed the participants about what was possible and enabled them to make informed comments about future possibilities.

7.6.3 Participatory Design

Participatory design is a collection of methods that were gathered together to facilitate the design of new systems and to involve users in that process. This it has accomplished with some success, however, some researchers have argued that the level of involvement of users has not been deep enough to realistically argue that there has been full participation. Also it has been argued that participatory design could be used at a much earlier stage than it is currently. This method demonstrates one way in, which participatory design tools and techniques can be used as an investigative tool as apposed to a design tool. In that we can involve users at a stage when we do not know what kind of device we want to build but know that there may be a need for a device that offers certain functions or services. The Home Workshop broadens the possible scope of PD to embrace the conceptually difficult world of the home and offers ways in which we can discover clues to enable us to design more usable devices.

7.6.4 HCI

HCI is an umbrella title for a myriad of different methods and tools to facilitate the building of new devices and systems. This is not a criticism but merely a point of fact. HCI provides methods and tools to enable designers, technologists and engineers a possible way forward in an informed way to the build more user-centred devices and systems. HCI research has mainly focused on the workplace and suffers from a lack of application in the home place, as pointed out in chapters one and three. HCI has also focused on using methods, such as the waterfall method (Sommerville, 1992) for design and development of systems, which is an appropriate method when you have a clear task(s) or system to computerise, but can lack applicability to situations were there is no comparable system and no user requirements, as such, to collect. The Home Workshop offers the possibility of offering a way of gathering requirements at a very early stage of the design lifecycle.

7.6.5 Sociological Studies

Sociological studies have mainly gathered information using two means: questionnaires and interviews (in various guises). These means have provided rich data that has greatly informed our view of the home and its artefacts as discussed in chapter two. One noticeable problem with these studies has been the lack of participation by children, especially children under twelve. Children are consumers of technology and are valued household members, therefore methods need to be employed that encourage children to participate in home studies. Morley found that children grew quickly bored and left the room when trying to discuss the use of the television, other researchers Livingstone (1992) for example did not intend to include them from the start. The Home Workshop showed one way (albeit a very limited one, in a very limited study) of involving full participation of families'. The children took active roles in the Home Workshop, with scenarios being the only exception. The children commented that they especially enjoyed the technology tour, design and re-design of devices.

7.7 Conclusion

The chapter started by explaining how the data collected was analysed. The method chosen for the analysis was Grounded Theory's constant comparative method. The method while time consuming enabled the researcher to see common themes that occurred across all the households. It would have been more difficult to extrapolate these themes across households from only viewing the materials in their raw form. The themes presented in Sections 7.3 and 7.4 aimed to elucidate and provide more of an understanding of the participants relationship with their technology in their homes. Each theme concluded with guidance for designers on the problems with how we currently interact with technology and how this situation could be improved in the future.

The Home Workshop as a method for investigating our relationship with technology in the home was evaluated. Each individual part of the method was evaluated on the basis of: whether or not the premise on which it was used was found to be correct (i.e. did the Technology Tour discover current problems with householders current use of technology), its ability to involve all household members (regardless of age) and did the data collected enable general design

principles to be found. It was concluded that the Home Workshop did indeed provide a method that would facilitate an investigation in the home.

The Home Workshop method was then compared to other methods which could have been used to facilitate a study in the home. This comparison revealed that the Home Workshop would provide data that would not have been found by some of these methods and that the Home Workshop may provide a way of encouraging more collaboration between designers and participants.

8 Conclusion and Discussion

8.1 Introduction

It was stated in Chapter one (Section 1.1) that there is a lack of methods that support designers in investigating technology in the home. As a consequence a programme of work was undertaken that goes some way to providing such a method. The work also supplies information that could be used by designers in the design of innovative system concepts. Two main strands of literature were reviewed in order to facilitate the building of a framework for a novel method: studies that had been undertaken in the home (Chapter two) and studies that had taken place in the workplace (Chapter three). Chapter two provided an insight into how designers had designed for the home in the past, not just the technology but the physical building itself. This chapter also provided valuable insights into our relationship with our homes and the artefacts they contain. Chapter three provided information on the techniques and methodologies available to investigate in the workplace, and in some instances the, home. The different methodologies and approaches had different expectations of the level of user participation allowed or expected i.e. some advocated user involvement throughout the process (Participatory Design) and some mainly at the requirements gathering stage (Contextual Design).

From this review it was clear that some methods could be adapted to facilitate an investigation e.g. paper prototypes and scenarios, in the home. However it was also clear that new methods were required to discover our relationship with technology in the home, and the technology tour and envisioning design in the home were developed. This resulted in a novel method being proposed: The Home Workshop, to facilitate the aims of the thesis (Section 4.2). The findings and results from the use of this method were outlined in Chapters five, six and seven.

The thesis also aims to provide designers with general principles for design in the home. This aim has been met by the analysis of the data which was analysed for usability and spatial key words as explained in Chapter seven (Section 7.2). From this analysis key themes were identified that were found to affect and mediate our use of technology in the home.

8.2 Conclusion

The work presented in this thesis demonstrated a methodology that would facilitate an investigation of technology in the home and provide designers with general principles that could successfully be applied to the design of innovative systems concepts. Further, the method employed involved all the members of a household. The reason for this was that there was a lack of reported research on how to undertake an investigation in the home.

The Home Workshop included all members of a household. HCI studies have taken place in the workplace, educational establishments, or laboratories, and this is where the methods and techniques for HCI have been developed. This has resulted in studies and methods that have mainly involved homogeneous groups, as apposed to the heterogeneous groups that this research tackled. This work has, therefore not only contributed to our knowledge of what methods may or may not be appropriate for the home, but also offered a novel method of involving people of all ages in their own homes in the design process.

The next two subsections draw conclusions as to whether or not the contributions outlined in Section 1.3 have been met and how they contribute to our knowledge of how to undertake a study in the home, which could provide designers with general design principles for novel concepts for home technologies.

8.2.1 Provide a novel method

This contribution was met by undertaking a literature review of existing methods from HCI and other research disciplines and extrapolating from this which methods would be appropriate for undertaking a study in the home. This review helped to build a framework for investigating the home, the Home Workshop. A set of studies was then undertaken, in five households. The methods used in the framework were then examined to determine their effectiveness i.e. did all the participants take part and contribute at each of the workshops?

All households did take part in all of the sessions with the only exceptions being Cooks'-scenario, and Suttons- critique and redesign. All of the participants expressed the wish to take part in home workshops in the future and said that they found their participation in the workshops enjoyable.

The Home Workshop demonstrated that people can articulate their thoughts on certain devices and services and that people may be able not just to provide answers to our proposals for devices or services, but also provide some ideas for devices and services themselves. In conclusion the methods employed by the Home Workshop would indeed inform designers and researchers how better to undertake a study in the home.

The table below summarises the main steps in the Home Workshop method. Hints and tips are given for each tool and technique to assist others who may wish to use the method.

Preparatory Session: Planning and collecting households.	
Tools and Techniques	Practical Tips
Gather households Households can be gathered by sending out emails to colleagues, family and friends asking if they know of any possible volunteers. Or by advertising in newspapers and magazines. **Investigate Equipment** An investigation into the appropriateness and availability of video recording equipment should be undertaken.	A full description of the workshops, purpose and duration should be sent out to the participating households. How and what to record during the sessions should be decided upon and agreed with the families. Permission to publish any of the data collected from the Home Workshop should be obtained from the families. A trial workshop is the most appropriate way of assessing the equipment.
Session 1: Investigate current problems and Future Possibilities	
Tools and Techniques	Practical Tips
Technology Tour The participants are asked to take the investigator/researcher on a tour of their homes and to relate their use of and experiences with each technology. The main thrust of the technology tour revolves around four key issues: ❑ what technology is present in each room; ❑ where is it placed; ❑ who uses the technology; ❑ how it is used.	An investigator should be sensitive to the participants' public and private spaces in their homes. An investigator should also be careful to ask all household members about their use of a technology as other household members can give a distorted view of the use of a technology by another member. Finally some of the most interesting technologies are the ones which are not visible, therefore participants should be asked if they have any technology in their household which cannot be seen.
Representations of emerging technologies The representations should orientate the participants towards thinking about new technologies for the home and aid discussions about technologies for the home. The representations of future technology should be: ❑ technology that will emerge in the next 2-5 years. ❑ technology that will be used in the home context. The discussion about the emerging technologies should help uncover essentials of use situations which may evolve in the future.	The participants should be encouraged to discuss the device. For example by asking the participant where they would place a device, how often they would use it and what for. It would be useful if the researcher kept in mind the four key issues used to orientate an investigator during a Technology Tour.

Scenarios Scenarios should be written that involve the participants undertaking a task which would involve them using various current devices in their home and possible future devices. The scenarios used can be as flexible, informal and as sketchy, or structured as needed. The scenarios help to confirm what technologies the participants use at the moment to undertake certain tasks.	Scenarios should be collected from families. Scenarios should also be envisaged for children of different age groups. The children in this study were found not to fully engage with the scenarios that were more orientated towards adult themes.
Inter-session activities: Collecting data in-between sessions	
Tools and Techniques	*Practical Tips*
Post-it notes *Post-it notes are an ideal artefact to leave with participants. The ease with which they can be written on and stuck to devices makes them an ideal artefact to leave in homes. They do not leave any permanent marks on devices. Participants should be encouraged to write any comments they want on the Post-its. The Post-its should be stuck onto an existing device or on to one of the future devices.*	*The post-it notes provided should be of an adequate size. An adequate amount of post-its should also be left for each household member. It was found in the studies that between 20-30 post-its were used, therefore, a minimum number of post-its to leave the participant would be 30 and a maximum (so as not to overwhelm them) would be 50.* *The Post-its used should be bright in colour. The reason for using brightly coloured Post-its is that they are less easily forgotten.*
Session Two: Contextualising ideas for the home in the future and daily life.	
Tools and Techniques	Practical Tips
Informal interview The interview is in the format of a discussion in which the researcher talks to the participants about the Post-its they have used. Additionally any issues that the researcher or participants want to discuss from the previous workshop can be raised.	This was a relaxed way of talking to each family member about the post-its they had filled in and their thoughts in between sessions. This part of session two could be undertaken with each household member individually or as a group discussion. The researcher should read through the Post-its with the participants ask them to elaborate each point they have made.
Materializing ideas for future technologies The focus here is on envisaging design. Participants should be provided with craft materials (pen, paper, glue, etc.) and asked to create visions of concepts for devices. They should be requested to either design a solution to a current problem or to envision a new device that would be of benefit to them in their homes. There are four reasons why participants should be asked to envision their own technology for the home: 1. Home technology at the moment is mainly built and designed by manufacturers and designers with little input from users. 2. to assist participants to think of their own solutions to current problems. 3. To extract and learn about the needs and wishes of the participants for the future. 4. To help some of the more diffident participants to create an overflow in their imagination. This would it was hoped enable them to make a contribution.	An investigator should bring along with them, if possible, some hard boards for the participants to lean on when drawing. Most of the participants were found to want to gesture and move around their homes when describing and presenting their design concept, this should be encouraged and an investigator should be ready to quickly follow and record this action description by the participant. Some participants may be reluctant to draw there are two ways to combat this: 1. the investigator can join with the participants in envisioning a device. This would show the participants that they were willing to act as collaborators in the activity. 2. The investigator can offer to draw the device as dictated to them by the participant. However, the investigator should take great care to only draw what is dictated. The participant should also be the one to present the concept and describe its use.
Session three: Sharing ideas across families. Modifying and elaborating designs.	

Tools and Techniques	Practical Tips
Critique In the critique part of the workshop the researcher introduces and explains the other participants' designs to the different family groups. Each paper prototype is passed around and the main concepts of the design are explained. The participants are then encouraged to comment on the designs. The purpose of the critique is to learn about what the other families think of one another's designs, to encourage them to think more about their own design, and to inform them of the other participants' ideas and concepts.	The participants should be encouraged to discuss all aspects of the design. Sometimes participants tend to focus on some particular aspects of the design this can be combated by asking them how they would use such a device in their home. An investigator should be aware that participants will not be as willing to critique a children's design concept as they are an adult's, even if the child is not present.
Redesign The participants are asked to re-design one of the other participant's designs. They are asked to choose their favourite design and redesign it. The intention is to gather data about possible new functions and about the usability of the designs. Also to see whether the participants could think of ways in which they could use this device in their homes.	Participants can forget which designs have which functions as a result of this they add functions that may already be present, therefore, a list of the devices functions should be attached to the drawing. It would also be useful to have a transcript of the participant's description of their device attached to the drawing. This would save the investigator from having to paraphrase the original participant.
Data Analysis: Analyse data collected from Home workshop	
Transcription The transcription notation used was: Silverman's 'Conversational Analysis Transcription Conventions' Silverman, (1993).	All the participants' utterances were transcribed and annotated during this research. This was necessary, in this instance, because the research was being carried out by an inexperienced researcher. However, if the Home Workshop was being conducted by an experienced researcher or a group of researchers such a transcription process would not be necessary.
Constant Comparative The method has four stages: 1) Comparing incidents applicable to each category. 2) Integrating categories. 3) Delimiting categories 4) Writing Theory (Glaser & Strauss, 1967, p105).	A large mass of data was collected as a consequence of undertaking the Home Workshop. The 'Constant Comparative' method helped the author to sift through this data to see whether themes were reoccurring throughout the data and across households. This analysis of the data can be cut if the researches aims are not as broad and exploratory as this work's were and if the research is undertaken by a group of investigators.

Table 8.1: Summary of The Home Workshop Method, with Hints and Tip for future Use.

8.2.2 Provide designers with general principles

General principles (presented as conclusions for designers at the end of each theme in Sections 7.3 and 7.4) that would guide designers in the design of home concepts were found as a consequence of the analysis of the data collected from the families' homes. Some of the main issues in the home were found to be: how we learned to use a technology, the lifecycle of a device and its maintenance, how we maintained or gave away our privacy, the utility of a device and the 'need' for

it, the importance of space (who had control over it and the devices within it) and place (where a device was positioned often effected how it was used). Similar issues were found to affect peoples' views on future technology. However, three additional themes were found: mobility, personalisation and automation, and principles for design were identified for them. The themes provided information on how we use technologies in our homes at the present time and how we wish to use technologies in the future. Conclusions and principles from this information were drawn for designers.

In conclusion, the Home Workshop worked well as an investigative method as it did indeed provide information that could enable designers to design innovative system concepts for the home, and more user-orientated devices.

8.3 Future Work

The work raised many interesting issues surrounding our present relationships with technology in the home and what people may desire for the future. The novel method presented showed that there is a way of investigating the home in a more collaborative way than has previously been attempted. However the method requires a more substantial investigation before it can truly be established as a usable method, therefore ways in which it could be applied to further investigations in the home are outlined in Section 8.4.3. The Home Workshop themes also highlighted areas and issues in the home that may benefit from further study, these are outlined in sections 8.4.1 and 8.4.2.

8.3.1 Space and Place

This study, and others, have highlighted the importance of the different spaces in the home. Venkatesh (1996) highlighted that attention should be paid to how well a technology had been assimilated into the social space of the home and its activities. O'Brien et al., (1999) found that we currently lack a clear understanding of the relationship between technological artefacts, the nature of the spaces and the activities that take place within the home. The findings of this research suggest that spaces in the home are extremely important if we want to understand how people use technology in their homes. For example, the models in Chapter five show the different views families have of the spaces in their home. These provide important clues as to their uses and relationships with the technology in their

homes. This study also found that these spaces are not always permanent and can be affected by time. Further, a new space was found in the home the 'communication space'. This space may be one which is destined to change over the coming years as more and more people use the internet and email. Research that investigated spaces in the home could help orientate designers towards building devices that will better suit the space they ultimately inhabit.

8.3.2 Learning

This work made some tentative findings surrounding the issue of learning in the home. It was found that there are problems with the current methods used to teach people to use technologies in the home. For example, user manuals are often left unread and unused even when problems occur with the technology.

Induction sessions were found to take too long and to be of the 'one-user-one-induction' set-up, which resulted in people not knowing how to use the technology or not being aware of the interactive services it provided., that could be of benefit to them. Some of the suggestions put forward by this study are that induction sessions should take into account that in the home more than one person may use a device and customise learning accordingly e.g. by age group. Further users should be given the option to have different levels of learning e.g. a quick tour of the system's functions or a full induction session. The lifecycle of the device should also be taken into account with users being able to quickly find and learn basic maintenance procedures and information.

People expressed the wish to want to 'learn by doing' and wanting devices to be intuitive and support this type of learning and interaction in the future (Gordon's recipe device is an example of this). If this type of learning is not supported then users may complain of the same problem as this Lisa computer user: '*I want to do something, not learn how to do everything*.' (Carroll and Muzmar, 1986, p39). New ways of encouraging learning of new technologies or systems in the home need to be found and assessed in the home. Research that focused on learning in the home and how people in the home set about learning new technologies would be of benefit to the HCI design and research community. This area takes on particular importance with the advent of more interactive technologies being used in the home. As Stewart's (2002) study and this study have pointed out, how

people learn to use a technology in the home environment is vitally important to the use of that technology.

8.3.3 Further work on the Home Workshop

The work reported here presents a novel method to facilitate investigations into people's relationships with technology in their homes. This study can only claim, therefore, to contribute to the corpus of knowledge that designers or researchers may have about people in their homes. The future challenge is to use this method in the real life setting of a research project that aims to build a new system or device for the home and to see whether the knowledge gained from the participants using the Home Workshop method results in a qualitatively better artefact.

Further work could focus on researching in more depth some of the themes that have been highlighted by this work, for example, the lifecycle of technologies through the home. What affect the different stages of a device's lifecycle have on its use or non-use. The other themes would also be worth investigating to measure how much or how little they affected the use of technology in the home.

Another way that the work could be extended is to focus on the concept of usability and user interaction in the home. This work found that people want to interact with their technologies in new and more interesting ways e.g. interactive learning and personalisation. These then may be key issues to the future use and acceptability of technologies in the home. Perhaps by investigating these concepts alongside the goals of interaction design, i.e. fun, rewarding, motivating and enjoyable, we may learn more about how to build more acceptable and enjoyable devices for the home.

The Home Workshop could also be extended to other parts of the design lifecycle such as design. For example designers could use the critique and redesign stage of the workshop to show participants in their homes their visualisations for the home and to encourage discussion, critique and redesign of their ideas. The Home Workshop could also be used at the evaluation stage. For example participants in their home could be asked to situate the device where they thought it was appropriate and to use the device in situ. This would alert the designers to real world problems that may affect the use of their proposed device.

Appendix 1: The Future Devices Shown to Families

Introduction

A myriad of devices were screened for the PhD thesis. Many advances have been made over the last two years especially in the areas of digital television, wireless applications and connectivity. Therefore these devices should be seen in the appropriate historical context. Before the workshops commenced a screening of devices was undertaken. Any devices thought to be of particular interest to the PhD were included. The future devices were only used as an attempt to introduce the participants to a small sample of the new technologies being produced.

Methodology

When screening a device, the following factors where considered pertinent: a) did the device interact with other devices; b) was the device intended to be used in the home; c) had the device been adapted in a new and novel way, d) was the device fixed or mobile.

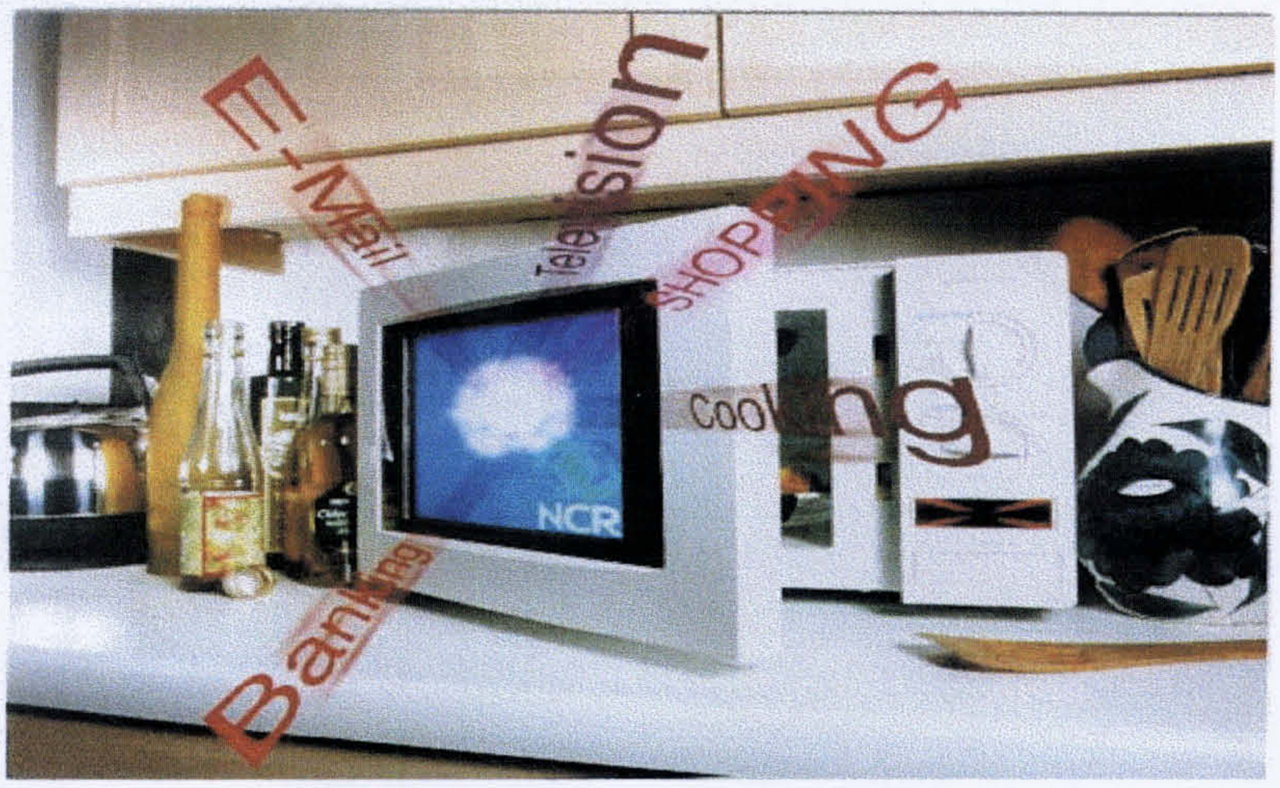
The information was mainly sourced from the web sites of major manufacturers. Information on interesting devices was downloaded and reviewed. The main features of the product were elicited from this information. If the device was thought to be of interest it would be researched further. Magazines and Newspaper articles were also reviewed to see whether they mentioned any new devices thought to be of interest to the home workshop.

Some of the organisational web sites viewed had information that, while of interest ,was unconnected to the home workshop such as a Computer Aided Design (enhancement) study at Sun Microsystems. Some organisations had no new products and were only developing the design of their existing products to make them more pleasing on the eye i.e. colour and shape. While the widest range of possible devices was considered other factors had to be taken into consideration: time (to research details such as; availability, related press releases, articles), depth of study and relevance to home workshops. The most difficult part of the device screening was the decision on what to leave out and what was thought to be relevant as every individual has a different perspective as to what is relevant.

Organisations

Olivetti:	www.orl.co.uk	Hotpoint:	www.hotpoint.co.uk
NCR:	www3.ncr.com	Sony:	www.sel.sony.com
Sky Digital:	www.sky.co.uk	Electrolux:	www2.Electrolux.se
Nokia:	www.forum.nokia.com	WebTv:	www.bbc.co.uk
Nortel:	www.rapidcontent.com/nortel	MIT:	www.techreview.com
Xerox:	www.xrce.xerox.com	BT:	www.bt.com
AT&T:	www.att.com	Bell:	www.belllabs.com
Sun:	www.sunlabs.com	Apple/Mac	www.apple.com
Philips:	www.research.philips.com	Channel4:	www.chat.channel4.com
WorldGate:	www.wgate.com		
BT:	http://www.bt.com/eshop	Intel:	http://www.intel.com/research/
Flex:	Esprit Theme: Information Access and Interfaces (Project no.P29158)		

NCR: Interactive Microwave



Main Features

- Home shopping: The user can order their shopping from any of the major supermarkets offering an on-line ordering service. The device can also arrange for the shopping to be delivered.
- Home banking: The device offers all the main banking facilities for example the user can check their account balance, transfer money and pay bills.
- email and internet service
- Television: By touching a symbol on the screen the user can watch Television.
- Cook: The Microwave will retrieve recipe suggestions and dietary information from the World Wide Web.
- Bar code reader

Sony: Set-top terminal for home networking

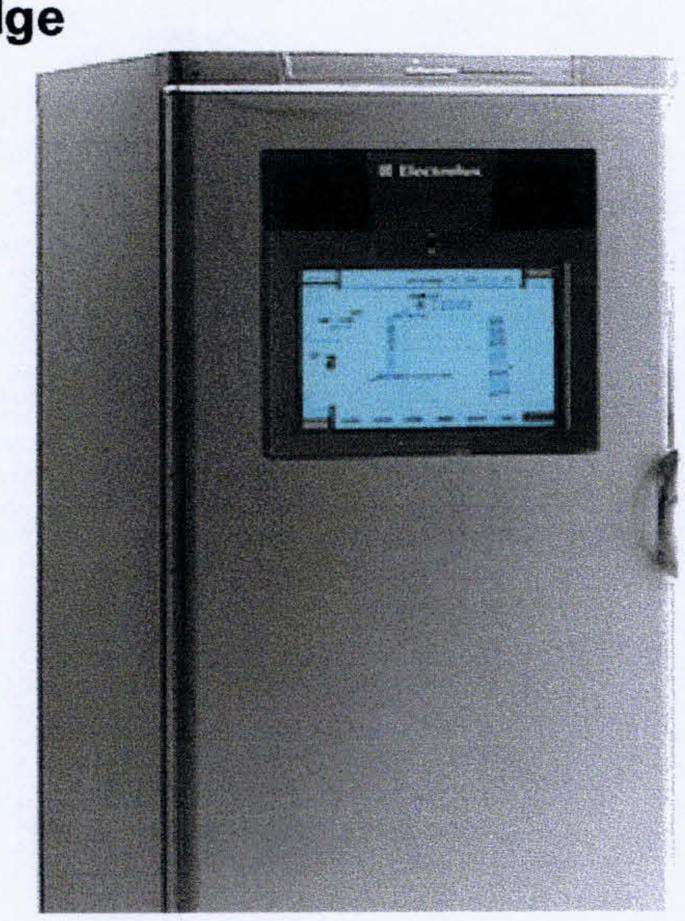
Main Features

- EPG (electronic program guide), which offers a variety of programs, from movies to news.
- High speed Internet access –up to 30mbps.
- Easy control of home networked AV devices equipped with an i.Link. interface, such as Mini-Disc recorders and camcorders of the future, use an integrated 'on-screen menu'.
- An intelligent search function which helps users find all of the content related to a specific topic from all the sources on the home network, including live broadcast, pay-per-view movies and users' DVD or CD library;
- Video telephony over a cable network.

The i.Link interface offers the ability for devices to send and receive digital commands and digital AV streams, such as video or audio, at up to 200mbps.

The first prototype has been completed and shown at the National Cable Television Association (NCTA) Cable'98 convention. Sony is still working on the set-top terminal.

Electrolux: Smart Fridge



Main Features

- Internet access
- Interactive shopping
- Banking
- Meal planning
- Food warning system

Additionally the fridge has the ability to give warnings about food freshness, make recipe suggestions and run diagnostics on other kitchen equipment.

Nokia: Wireless Application Protocol (WAP) enabled Phone

Main Features

- Stores up to 150 names and e-mail addresses
- email
- Address book has a 'search' facility
- Qwerty keyboard
- Calculator
- Interactive text services, for home banking, shopping and information services.

Intel Video Phone

Main Features

- Stores up to 150 names and e-mail addresses
- Address book has a 'search' facility

The Home Information Centre

Main Features

- Email and internet access
- Television,
- Voice activation
- MP3 player
- Information services.

Appendix 2: Scenarios

'Guests for Dinner' Scenario

You are arranging a dinner party for Saturday night for six guests. Please explain how you would arrange your dinner party, the list below may help you to work through this scenario. When working through the scenario please mention all the present or future artefacts, tools, or technologies which you may use to help you organise your dinner party.

Possible steps:

1) Invite the guests

2) Decide what you are going to cook

3) Arrange the buying of the food

4) Organise the preparation and cooking of the food

'What shall we do tonight' Scenario

You are organising a night out with friends, explain how you would organise your night out, the list below may help you. Please mention all the present or future artefacts, tools, or technologies which you may use to help you to organise your night out.

Possible Steps:

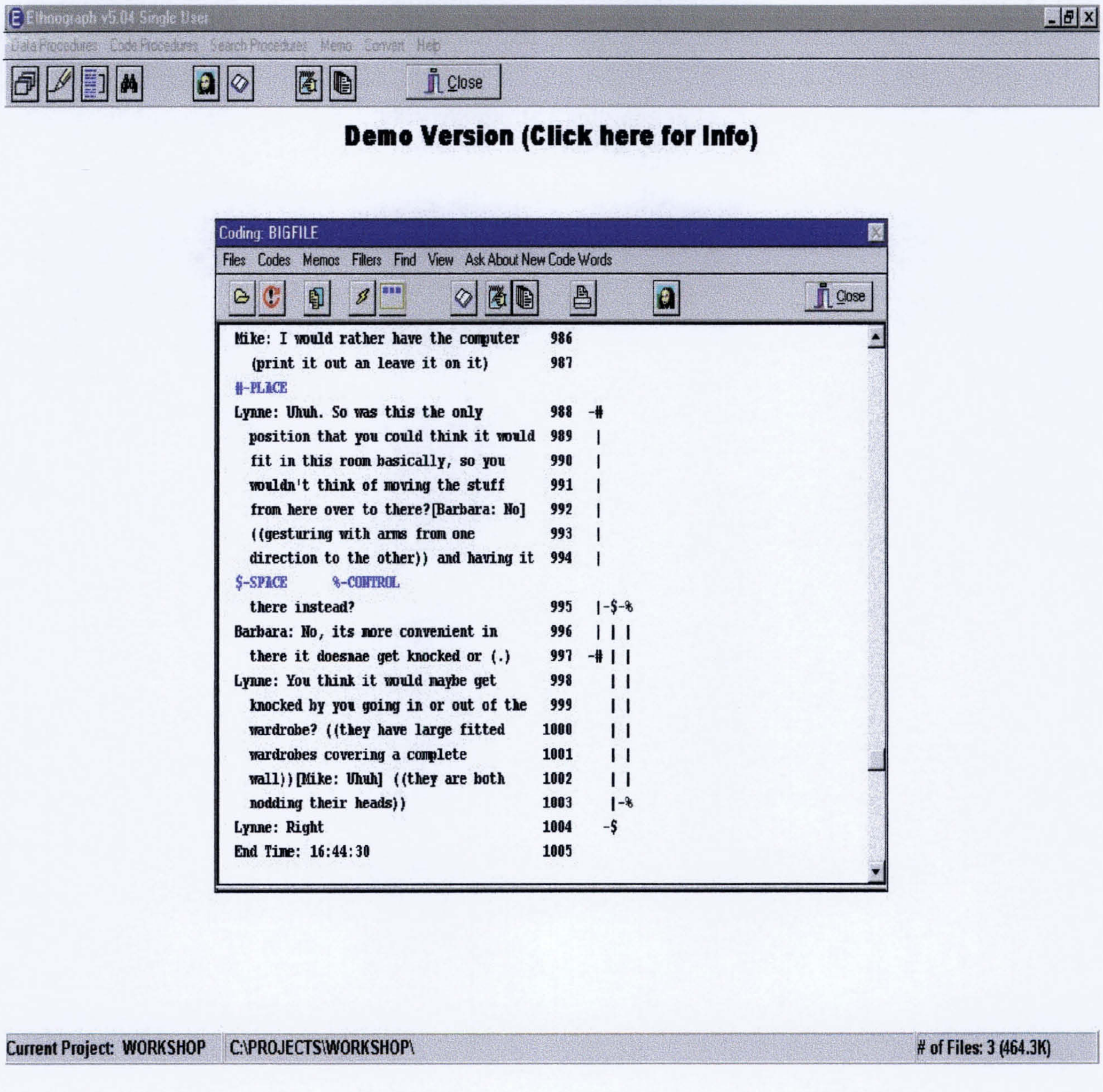
1) Invite whom you want to go

2) Decide where you are going

3) When you are meeting them

Appendix 3: Screenshot of Ethnograph

Below is a screenshot from a transcript while it was being coded and analysed in Ethnograph.



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