

Patterns of Home Life: Informing Design For Domestic Environments.

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Abstract. This paper considers how we may provide support for the development of general design principles in domestic environments. In particular we examine the potential for using *design patterns* as a means of presenting ethnographic material and outlining design solutions. The paper reports on the development of an initial pattern language based on our studies of a number of domestic environments and offers a general structure for presenting these patterns. Finally, we briefly reflect on our experiences of developing an on-line set of patterns for this class of environments.

Keywords.

Domestic Environments, Ethnography, Systems Design, Pattern Language, Design Patterns.

1. Introduction: Ethnography and System Design.

Over the last decade research has routinely attempted to inform the requirements and design of IT systems through ethnographic studies of work in a number of application domains.¹ Despite the growing acceptance of this form of

¹ Including air traffic control [1] financial management [2] software [3], university administration [4], virtual environments [5] and home working [6]. This diversity is reflected in other CSCW research that has been concerned with general practice [7], architectural design [8], research [9], publishing [10], underground railway control [11], dealing rooms [12] and many more.

investigation at least one perennial problem has been the problem of communication between fieldworkers and designers. In tackling this problem researchers have developed variations on their methods [13; 14]; novel presentation mechanisms [15; 16] a variety of notations [17] and general methodological reflections on both ethnography and systems development [18]. While techniques have emerged that allow field studies to be better articulated to developers and designers it is notable that little systematic concern has been given for developing a corpus of good design practice and experience drawn across this body of research.

From the outset those involved in using ethnographic studies in the design of cooperative systems have had to consider how to marry the results of social science studies with the needs of developers [19]. These early attempts at undertaking ethnographic studies in the context of design tend to focus on undertaking particular studies and exploring the utility in a range of applications [20]. While this work has led to various approaches for engaging ethnography in the design process, the fundamental question of understanding the more general role of ethnography in design has emerged as central [21]. Currently, we are at the stage where a number of researchers are exploring the development of general design principles and guidelines and the extent to which ethnographic studies can contribute to the formation of general concepts and principles of systems design remains an open question.

Developing useful and applicable guidelines for systems design is a thorny issue, as it requires a balance to be struck between the need for the emergence of general principles and the importance of detailing everyday situated practice. If we are to provide more general design principles techniques need to be uncovered that allow the results of ethnographic studies to be married with more general statements of design. This paper seeks to address this problem by exploring the potential offered by design *patterns* as a means of presenting ethnographic work. We do so by exploring the construction of *patterns of cooperative interaction* - patterns of cooperation and IT use that recur across a number of settings. In this particular case the patterns we are developing focus on the general setting of the home and draw from a number a series of studies of different domestic environments. The intent of these patterns is that they will serve both as a means of describing common interactions and as a vehicle for communicating the results of a specific analysis to designers to be drawn upon and used as a resource for the designers of future systems. The presentation of different patterns of interaction seeks to allow different *general principles* and issues to be presented alongside *specific* material drawn from empirical studies. Thus rather than seek a translation from the specific of the empirical work to the general of the design principle we are seeking to explore mechanisms that allow both to be present and available to developers.

2. Design Patterns

The origin of patterns lies in the work of architect *Christopher Alexander* reflected in two books, *A Timeless Way of Building* and *A Pattern Language* [22; 23]. Patterns are devices to share knowledge about design solutions and the setting in which a solution is applied. The reoccurrence of situations that have a familiar feel lies at the core of the argument for patterns. Designers often encounter situations that are similar to previous ones. This raises the issue as to how to solve a particular situation on any given occasion by drawing on these previous experiences. Design patterns have been suggested and applied for this purpose in architecture for over twenty years. In addition, patterns have been examined in software design [24; 25] and, more recently, in the HCI community [26; 27] as a means of recording design solutions. A number of researchers have also suggested the application of pattern techniques to convey different forms of organisational structure. Perhaps the most comprehensive of these is provided in Coplien's on-line "*A Development Process Generative Pattern Language*" [28] which represents different organisational structures in software development. The appeal of patterns for interactive systems is that they provide a flexible means of presenting design solutions. Two distinct applications of pattern currently seem to exist namely *Activity Patterns*: that describe existing activities and organisational structures that solve different problems and *Design Patterns*: describing style guidelines and solutions to particular problems.

We wish to consider the use of patterns in a slightly different way by considering the development of patterns that span between patterns of understanding activity and the provision of design solutions. This builds upon the work of Erikson and his discussion of the utility of patterns to describe workplace settings. In the application of pattern techniques to a single study he outlines the feasibility of using patterns as a *lingua franca* for multi-disciplinary teams. We wish to further explore this work by attempting to develop a pattern language for a particular setting and consider the issues involved in the construction of pattern languages of this form. Our turn to patterns to convey fieldwork reflects a focus on providing supporting mechanisms that allow analysts and designers to draw upon and interpret ethnographic research as a resource for design. The issues that we seek to address include:

- Do common patterns of interaction exist across a range of settings at a useful level of abstraction?
- Can a 'pattern language' or template be developed that allows these different patterns to be documented?
- Can these patterns be used effectively in the context of studies of a variety of application domains for interactive systems development?

The problem of producing general design guidelines and standards is not

unique to research on cooperative or CSCW (computer supported cooperative work) systems. The problem is, however, amplified because of the strong, traditional emphasis in the study of cooperative systems on the situated nature of work and the importance of considering the real world. In contrast to other approaches to presenting design principles the development of a pattern language focuses on using examples drawn from the real world. It is this exploitation of the real world as a means of conveying these principles that offers considerable potential for developing principles drawn from ethnographic work. In order to investigate the general utility of this approach we have sought to explore the development of a pattern language based on a re-examination of a series of existing studies of technology in domestic environments.

3. Technology & the Home: Studies of Home-life.

We have chosen the 'Home' as the setting for the development of patterns for a number of reasons. Besides the obvious resonance and commonality of various spatial and architectural concepts, it is now widely realised that the home is likely to prove an important site for new information technologies.² The convergence of a number of technologies which link computers with various communication and entertainment technologies, have created new possibilities, among them home-shopping, video on demand, home banking and so on. The inspiration behind innovative devices such as the 'Microwave Bank' or the 'Intelligent Bin' [29] has come from trends towards 'connectedness' and the embedding of 'intelligence' into a wide range of everyday appliances whilst simultaneously drawing upon particular models of the social and spatial organisation of the household and domestic activity. Nevertheless, Moran's (1993) report for the European Commission on the Electronic Home [30] while arguing that new domestic technologies, both actual and potential, are likely to have a major impact of the relationship between the home and the wider environment, bemoaned the lack of effort that had been expended on studying home life and the implications of such technologies for daily life.³ After discussing initiatives in the US, Japan and Europe, the report comments:

"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."

²Venkatesh [1995] identifies four different industries which are now viewing the home as the next site for technological development: telecommunications industry, information industry, computer industry and entertainment - many of these working in close collaboration.

³ The applications and activities addresses were Home Management Systems, Household Applications, Communications to Support Interpersonal Relations, Leisure, Entertainment, Educational and Cultural Applications, Well-being, Health Care and Lifestyle Applications, Teleworking and Transportation.

The report concludes by welcoming new initiatives to study the experiences of 'real householders' and particularly mentions exploring ethnographic approaches as a method of investigation. It suggests that such research practices may illuminate design directions as well as possible social factors which might help or impede the adoption and diffusion of domestic technologies.

While, or perhaps because, the household is a familiar social institution relatively few ethnographic studies of the household exist. As well as the extremely extensive anthropological research on kinship, historical studies of the ways in which family patterns have changed over the centuries, and studies of the introduction of and interaction with various household technologies, provide a resource for our investigations. Martha Banta's remarkable book, 'Taylored Lives' [31] furnishes a number of illustrations of the spread of technology into American homes alongside an accompanying 'scientific' and 'modern' philosophy derived from Taylorism and Fordism. So, for example, in the early 20th century Christine Frederick in 'The New Housekeeping: Efficiency Studies in Home Management' was writing of the efficient and standardised design of kitchens and kitchen fittings;

"The first step toward the efficiency of any kitchen is to have the kitchen small, compact and without long narrow pantries and closets...a careful test of the way work is done in a "roomy" kitchen will discover waste spaces between the equipment, and hence waste motion between the work."

"The most important point in the choice of fittings for the kitchen is that of "washability". ... Open plumbing, tables covered with zinc, galvanized iron, or porcelain, are all essential to the sanitation of the standardized kitchen." ([31] p 238)

Such an approach to individual rooms within the house was merely a (natural) extension of a philosophy of rational spatial planning applied to the entire building⁴ - "House patterns, scientifically manufactured and marketed to enhance scientific management of their owners' lives" - and, as Banta suggests, designers of 'ready-made' houses attempted to apply Fordist principles of mass assembly of standardised components.

One of the main problems in thinking clearly about the household is the number of longstanding myths that have to be addressed; myths that are often the product and focus of social science research. Popular and social scientific concerns about the declining nuclear family, the loss of neighbourhood and community, the growth of urban malaise and so on go beyond the narrowly academic to surface in political debate and ultimately in aspects of design (see, for example, Oscar Newman's (1972) notions about 'defensible space' [32]). This

⁴ .." ..the notion of planned spaces occupied by good families, right conduct, and efficient house space collides with all that is unplanned, sprawling, unfenced and uncontrolled. The will of the planners was not to be denied, whether they set about designing farm buildings in middle Virginia, little houses on the prairie, or the cliff dwellings of the modern city." (Banta: 220)

is hardly surprising given both the near universality of the household as the social context in which most people live and the intimate intertwining of social and domestic life such that the household becomes the stage upon which global trends may be played out. Indeed, the EC Report on the Electronic Home (Moran, 1993)[30] identified a number of key trends which were influential in the development of ideas about the electronic home. These included near zero population growth, the rise of the proportion of the elderly in most industrial states, the decline of multi-generational households, the increased number of 'non-traditional' homes, new forms of work, increasing leisure time, the permanence of significant number of permanently unemployed, as well as a great sensitivity toward environmental and other non-materialist issues.

3.1. Technology at home

Until the 1980s there were few studies which attempted to investigate household interactions within the domestic environment itself. In the 1980s a number of studies of the household were carried out which centred upon the use of the media, particularly television, and communication technologies and the ways in which they were actively incorporated into everyday lives and conversation [33; 34; 35; 36] These studies broadly followed the qualitative research tradition with its aim to provide intensive empirical documentation of members' perceptions of what takes place in the home. This emerged out of a dissatisfaction with the crude statistical approaches to the analysis of media use which failed to provide details of the everyday interactions within which the media was situated. Lull (1991), for example, used research assistants lodged in the host households, while Morley (1986) used focus groups of householders selected against relevant socio-economic categories. The majority, however, used extensive interviews with household members in their homes to obtain their accounts of the use of media technologies.

The shortage of detailed knowledge of household environments does not reflect a lack of research into the role of the home [37; 38; 39]. Rather it is indicative of the *nature* of this research and its *relation* to the development of future technology. Much of the work that has taken place has drawn its inspiration from 'hyped-up' visions of technological progress and consequently has attempted to address the nature of technology as a means of transforming the home. In fact, the 'transformative powers' of technology seem to leave the social organisation of the home resolutely unaffected⁵. Given the fundamental importance of the household within the everyday lives of ordinary people, an

⁵ " ... we have a paradoxical picture emerging. From one perspective - that of ICT [Information and Communication Technology] and its associated consumer culture - the most radical changes are occurring in modern culture. But from a second, complementary perspective that of family relations and their associated consumption practices, a picture of continuity with the past is in evidence."

environment that is characterised and treated as a place organised to serve important elements of their day-to-day lives it seems hardly surprising that the technology is accommodated firmly within these practices and indeed becomes another means by which such practices might be articulated. As Sacks indicates,

"The technical apparatus is then being made at home with the rest of our world. And that's a thing that's routinely being done, and its the source of failures of technocratic dreams that if only we introduced some fantastic new communication machine the world will be transformed. What happens is that the object is made at home in the world that has whatever organisation it already has." [40]

New forms of domestic interactive technologies are, quite routinely, 'made at home' with the current social organisation of the domestic environment, no matter that 'radical changes' are occurring in the development, manufacturing and consumption of ICT's. Uncovering the detailed nature of this homelife is, consequently, essential to the developers of future interactive systems for the home and requires us to consider empirical studies of the home as part of the development of this class of interactive systems.

4. Ethnography and studies of homelife.

"Many technology providers have a sound knowledge of the technology they produce but not of the social context in the use of technology." [8]

"In order to discover patterns which are alive we must always start with observation" (23: p254)

As part of our contribution to the growth of a corpus of knowledge of the home we have undertaken studies of household life within an ethnographic tradition, studying interaction within their natural 'real world' settings, and working towards a framework for the analysis of the social organisation of the household as a means of supporting the design of interactive systems in this area. The explicit aim of the studies was to develop an understanding of the detailed everyday activities in the home with the emphasis placed upon the provision of a 'thick description' of daily life within the home - to present a picture of the ordinary patterns of interaction within the selected domestic environments as a practical accomplishment of the various parties to home life.

We have undertaken a series of studies intended to sensitise designers and developers to the character of 'real world' household domains (O'Brien and Rodden 1997)[6]. The topic of our enquiries has been how is it that homelife is ordered, and in what ways are technological artefacts employed to accomplish such organisation on some occasions? Our interest has been in explicating some of the social dimensions of households relevant to the potential uses of new domestic technologies. As in the ethnographic study of more traditional and more obvious 'work' sites we suggest that household technologies should be designed

with a more grounded understanding of existing patterns of social interactions to serve as a baseline in order to better assess not only how one might think about such technologies but also, and as important, to obtain a better sense of those aspects of household sub-cultures which design would need to take into account⁶.

This desire to be 'attentive' to the everyday 'work' of a household is, of course, one of the motivations for the increasing use of ethnomethodologically informed ethnography in cooperative systems research. In contrast to a common sociological attitude which views specific social settings such as the home, as sites of generic, abstract 'social processes' the ethnomethodologically informed ethnographic approach, is particularly focused upon the distinctiveness, the specificity, of the setting under study. The suggestion is that in terms of the organisation of *practical* conduct, though there may be abstract, general similarities between one setting and another, it is nonetheless unavoidable that one must come to terms with the particularities of the setting if the day-to-day affairs of the setting are to be carried out. In terms of many sociological strategies for generalisation, the fact that people are engaged in a particular kind of activity is only an *analytically incidental* feature of what they are doing, is only a concrete instantiation of abstract, generic and formal processes, which means that there is little investigative motivation to attend to the practicalities of activities, to attend to the nature of those activities as realisations of the kind of 'work' that they are. In contrast, the ethnomethodologically motivated approach has every reason to attend to the distinct character of the particular setting (in this case the home), to give priority to the fact that these persons are 'doing' 'watching a video, 'phoning the bank', and so on, and to seek to understand the particular circumstantial conditions for, carrying out those activities in actual cases. We believe that such an approach has the potential to contribute to the design process through making the rich practical, *organisational* detail of the setting available as a resource for design, both as a series of 'sensitising concerns' and as an empirical reference for the development of 'patterns'.

Other, perhaps more '*predictive*' methods, dealing as they do in statistical aggregation, are unable to identify the elements of the *organisation* of homelife as they emerge *from within the phenomenon*. Rather they tend to overlook the persistence of this *organisation* and consequently fail to draw upon it as a resource for design. This oversight results in the production of a mechanistic view

⁶ The particular kinds of issues these studies have addressed include:

- what communications technologies are available within households and how are they used?
- how do persons within households organise their activities through communication technologies?
- how do persons within households organise their accessibility to others within and without the domestic environment?
- how are spaces within domestic environments organised?
- what are the possibilities for alternative media spaces within domestic environments?
- are there thresholds of accessibility and connectivity which can be modelled in new media spaces?
- what affordances of existing social arrangements can be built upon in the design of new media spaces?

of non-technical, organisational elements of domestic environments as an application domain for interactive systems. - glossing them as resources for theory construction, rather than treating them as topics of enquiry. By way of contrast our studies lead us to the conclusion that it is precisely these elements of the 'non-technical' elements of homelife - its social organisation - that provide valuable insights for the successful design of domestic technology through their contribution to the respecification of our notions of 'interaction'.

5. The 'homes' studies - principal findings and features for design.

The aim of our methodological approach has been to provide an understanding of the context within which domestic interactive systems will have to operate, an understanding concerned with more than 'merely' providing detailed description, but with generating an analytic framework within which the prospect of 'respecifying the [design] problem' is facilitated [Blythin et al 1997][2]. Here we briefly indicate certain key areas of our findings which we argue provide a valuable general resource for the design of systems since such rich accounts of the mundanities of daily homelife highlight issues that impinge directly upon the design process. These themes, intended to 'bring to view' aspects of household life, emerged as *connected* constitutive elements of the application domain within which household technologies have to operate⁷.

5.1. *The importance of daily routine*

Routine concerns of work and children underwrite the day-to-day existence of householders who organise themselves in order that such mundane yet essential activities get done. Sets of actions must emerge which meet these fundamental aims in the least problematic manner - these routines do not 'fall from the sky', as it were, but emerge through the daily activities of householders ordering their lives. Claims to the 'ownership' of certain spaces are accordingly closely related to the daily routines of household members - individuals had a precise knowledge of each other's routines and tended to behave in a manner so as not to contravene one another's 'spaces' at such times. The configuration of the household and the technology within it reflects these routines and is also manipulated to facilitate and maintain them.

5.2. *Households as technological places*

Domestic environments are massively and increasingly technological places, and

⁷ They are not to be treated as isolated and discrete features of households. Identifying them separately in this way is for ease of presentation and discussion.

one feature of our interest in households was in the home as constituted around communication technologies; in the ways in which members of the household used such technologies as telephones, answering machines, TV and VCRs, radios, and so on. What comes across strongly from our studies is the ways in which ICTs have become so dominant within households for facilitating a wide range of activities. For example, massive connectivity means that virtually anyone can be reached using the telephone and it has consequently become an essential instrument of communication upon which nearly everyone now depends. Moreover, the telephone has become a technology that can be 'seamlessly' interwoven into a variety of ordinary activities.

5.3. Households as interpersonally managed spaces: - the ownership of space; the management of 'overloaded' space

Our studies continually highlighted the situated nature of every activities within domestic environments. People undertook particular actions within domestic environments often *precisely* because of the nature of these environments. Understanding the highly contextual nature of these requirements means that we must look closely at developing an understanding of the nature of activity within the context of the physical places it takes place in. Understanding these activities and developing design guidelines requires an examination of the relationship between technology and space. A related notion was that of the home as 'display' - making the obvious but important point that households are more than simply utilitarian arrangements for living, but also the setting for a whole series of claims about 'identity' 'style' and so on. Finally, another related theme that emerged in the fieldwork was the idea of the home as sanctuary, a place of refuge and an especially private place.

5.4. The coordination of homelife

This theme emphasises the way in which homes are made to work by the actions of those managing the activities within them. Much of the skill of living successfully within environments is managing the daily milieu of activities within the confines of the space available. The domestic environment and the technology within these environments became resources used to coordinate the home. Activities were synchronised and managed through different technological artefacts. For example, people often used broadcast media (Radio, T.V.) to order their daily routine. Similarly, people would exploit the nature of different communication devices to coordinate the activities in the home.

What is clear from our studies is that the relationship between the activities within the home, the technology that people use in domestic environments and the arrangements of the environments themselves is a complex one. Presenting this complexity and the development of different solutions to the problems that emerge provides both a considerable challenge and an ideal opportunity to explore the potential of patterns as a means of presenting this information. One

reason that this environment is so promising is because of the strong correspondence between spatial arrangement, technology and activity within the home and the use of patterns within the architecture community to consider the design of space. In the following section we present the development of an initial pattern language for the presentation of studies of domestic environments and the issues of cooperative systems within this kind of environment.

6. A Pattern Language for cooperative systems in home environments.

"..every pattern we define must be formulated in the form of a rule which establishes a relationship between a context, a system of forces which arises in that context, and a configuration which allows these forces to resolve themselves in that context" ([23] p253)

Although design guidelines and standards existing for both software development and interactive systems they are often accused of being inflexible, overly abstract and lacking attention to the role of users. This problem is amplified in the case of CSCW with its strong emphasis on the situated nature of work and the importance of considering 'real world', 'real time' activity. In contrast, the development of a pattern language focuses on using examples drawn from the real world as the means of conveying design principles, bearing in mind Shapiro's (1996) injunction that;

"Design is not an exact or an absolute matter, but is about simply "doing one's best" on a range of dimensions - functionality, time, cost etc. - and in relation to large numbers of divergent and conflicting objectives. In a messy and imperfect world which is already full of tragedies, ironies and cock-ups on every side, systems developers build on the past in the hope of coming up with something better than was available before .. design, as with almost every other practice in the real world, is to do with 'satisficing'.." [41]

Patterns are a way of conveying to designers some sense of the application domain. They are, as Erickson suggests;

"..ways of allowing the results of workplace studies to be reused in new and different situations. .. ways of representing knowledge about the workplace so that it is accessible to the increasingly diverse set of people involved in design.." [26]

Essentially a *pattern language* is a network of patterns of varying scales; each pattern is embodied as a concrete prototype, and is related to the larger scale patterns that it supports, and to smaller scale patterns which support it. Patterns exploit a range of media including photographs, diagrams, standardised notations and natural language.

In this paper we extend the application of pattern languages to consider the description of interactive cooperative systems within domestic environments. The principal difference between this work and patterns work in software design and HCI - apart from the application domain - is that we wish to explore the use of

pattern languages as a *descriptive* technique. This contrasts with the software patterns community who tend to use patterns more prescriptively⁸. The goal of a pattern language is to capture these patterns in their contexts, and to provide a mechanism for understanding the non-local consequences of potential design decisions. Ethnographic techniques have a long history in the study of computer supported cooperative work and in explicating the details of ‘context’ in a number of application domains. In examining the application of patterns to aspects of information technology distribution, access and use within the home we are, in many ways, revisiting Alexander’s own concerns reflected in designs such as "Couples Realm" (Design 136 & 253) and "intimacy gradient".

Although there are a number of ways in which patterns can be and have been presented - indeed this is a potential and developing problem - the general technique for discursively documenting patterns is to exploit a template that embodies in a fairly systematic manner some key concepts. These include:

- The motivation for a particular pattern and a description of what the problems it is seeking to solve
- The context in which the pattern exists and any prerequisites that need to be in place for the pattern to be used.
- A range of illustrative examples that show the pattern in practice.
- Some description of the overall structure of the patterns and how they relate to each other
- The consequences of using the pattern...both positive and negative.

The use of a pattern template seeks to provide consistency in the *description* of patterns as well as facilitating the *recognition* of appropriate patterns for design and relationships between patterns. However, each set of patterns tends to adopt its own particular notations for presenting each pattern. In the following sections we present an outline set of patterns we have constructed as a means of making the results of the empirical investigation of the domestic environments available to developers. To allow the potential to explore links with other forms of pattern, the notation we use borrows heavily from the one suggested by the University of Brighton [42] for HCI design. We represent the patterns as HTML to allow easy access and browsing of the patterns and their interconnections. The overall pattern template is shown in figure 1.

⁸ One of the challenges we foresee is the need to marry the descriptive elements of patterns as we envisage their application with their more prescriptive uses in these other research communities.

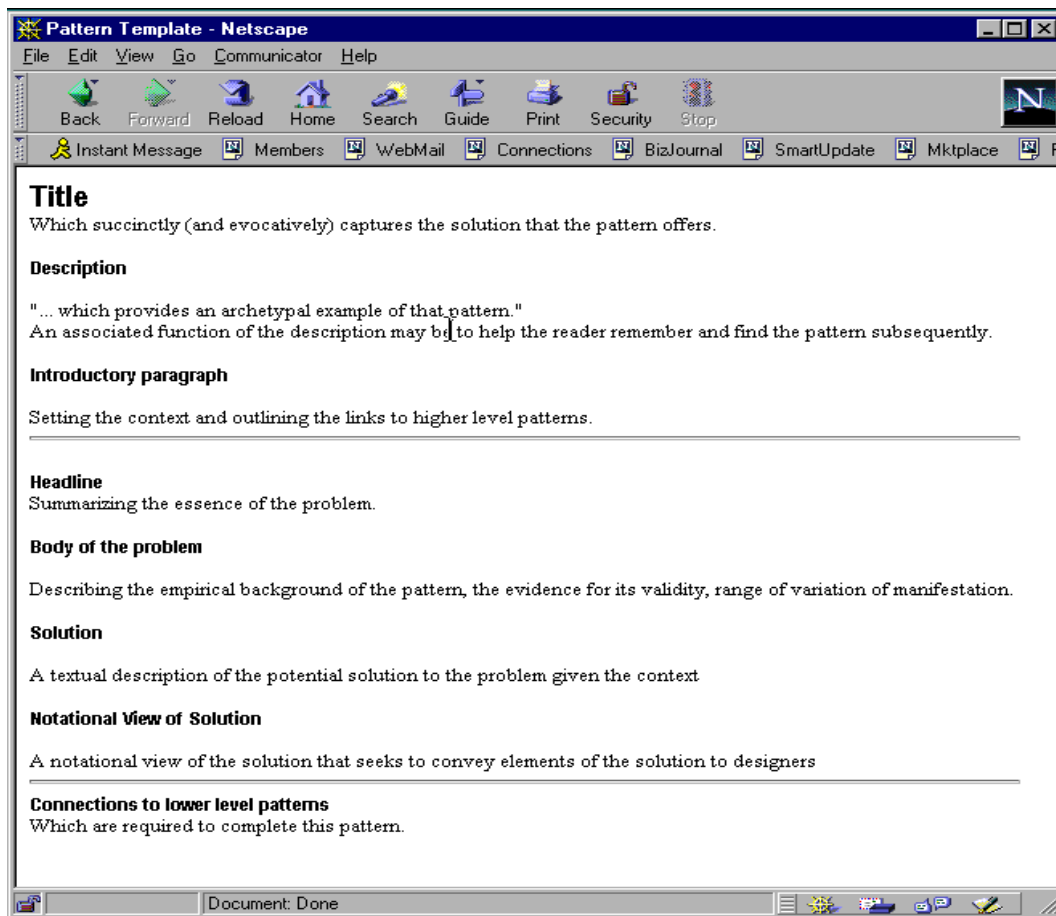


Figure 1. The Pattern Template.

In the follow sections we present a limited number of our initial domestic patterns based on and supported by the empirical ethnographic data gathered from our studies of homelife. In each case a general description of the pattern and the empirical observations on which it is based will be supported by the presentation of a more formal structured pattern. The more formal pattern is represented as an html page and linked to others in the pattern language.

6.1. Pattern 1: "Multiple Users Need Multiple Access"

Our first pattern - "Multiple Users Need Multiple Access" - aims to address the problem that arises when a high degree of functionality is concentrated within a single 'box'. For example, in IT this is seen in the familiar 'set-top-box' used by the providers of interactive services to the home. More prosaically this is evident in the traditional domestic cooker. The problem raised here is that the risk is run that the distributed nature of the everyday use of technology is made problematic and the equilibrium of homelife is potentially disrupted. The consequence of this can be, and frequently is, deemed to be extremely negative by householders :

M "What if I want to check my bank account while kids in the middle of playing a game ... you've only got one box of tricks haven't you? I mean I take it won't run more than one television at once ... yeah and what if I just want to sit in here and relax and F wants to do an Open University course?"

The most successful domestic technologies allow users to organise themselves and mesh seamlessly with that organisation. Consequently the physical location of domestic technologies is an important and complex issue. Observation and everyday experience make clear (though because it is so ordinary and unremarkable, its significance is often unappreciated) that there is a *pattern* to the arrangements of artefacts within households. Much of this is governed by utilitarian considerations, houses, and their appliances, are the outcome of a long evolution of design which has produced spatial arrangements which, to a large extent, incorporate an ecological division of location with respect to function. Accordingly, appliances that deliver these functions are to be found within these locations in the domestic environment. However, other appliances are more mobile in that their placement can, in principle, be anywhere within the house. However, this is not merely a utilitarian arrangement it is also normative as reflected in ideas about the 'ownership' and 'shareability' of domestic spaces.

Ownership refers to the ways in which it can be said that certain spaces 'belong' to particular members of the household, either singly or collectively (for example as children or adults). This is not a matter of legal ownership but has to do with a range of informal rights and obligations that arise over locations in the home. 'Ownership' is also closely related to issues of the 'shareability' of spaces and places and increasingly technologies and the information they permit access to or distribute. So while 'on-line' banking or 'teleshopping' can be delivered through the family television conventionally sited in the lounge whether this is desirable is questionable. The purpose in pointing to these features of household social organisation is to bring out the subtleties of household interaction with regard to the issues of the public and the private, and to provide a context in which to think about the location of technologies within the household. The issue in this respect is to determine whether the technologies are private to particular members of the household or whether they are public. The choice need not necessarily be quite so stark as this - after all, the technologies may permit degrees of privacy - but is relevant to where they are located within the household since this is also relevant to ownership and shareability. To whom in the household will they 'belong'? Who will 'own' them? Are they publicly available within the household? What level of shareability is possible? What level of control over these is desirable and by whom? What level of intrusion of other activities is tolerable? are just a few of the questions that would need to be thought about in the development of domestic networks and their related technologies.

The pattern "Multiple Users Need Multiple Access" are also linked to related patterns concerned with issues such as control, security and privacy in the use of technologies in domestic environments. A pattern concerned with the control of domestic technology recognises the fact that the control of access to all media is seen as an integral element of responsible parenting, as one of the ways in which parents express appropriate control over their children.

M "... if you let them watch anything when they're still forming their views and opinions, they **can** get the wrong idea ... I think if you've got children that you've ... started the right way ... that you give them certain moral values to, then they can watch programmes that are maybe less appropriate or not appropriate, but they've already got the moral basis there on which to ... make judgements, and you know fine that at the end of the day they're going to see things that are not appropriate, perhaps ... or which you don't think are appropriate or which are downright bad ... but you've got to give them the start that ..."

F "... but things like Power Rangers and, you know, one of the things that is popular now, which I know some parents at school sort of talk about and think they're not suitable, not appropriate, wrong role model's what you say ... that never worried me if they watched the sort of odd thing like that, because they were only watching the **odd** programme like that, they weren't sitting on front of this sort of thing all day ... so they, they by and large took as what it was ... it was a make believe television programme, it wasn't ... they seemed to understand that it wasn't reality ... that they weren't going to go out and find these things"

Similarly patterns concerned with domestic technology privacy acknowledge that, despite the 'public' face of the home, privacy is also a closely guarded feature of all homes, and is indeed seen as one of the major constitutive elements making the home distinct from other locations.

M "One of the things that I don't like about living here, is the fact that, we've realised that everybody can hear exactly what you're doing"

k "Yeah they're not very soundproofed ... if you have a row, say ... 'cause I've been outside and I've heard people rowing ... and we were talking about this with our neighbours the other night, 'cause they'd heard a huge row going on next door at New Year and we've had rows, and we're thinking 'Oh God! People will have heard everything that we've said!'" [Laughs]

Observations such as these raise an interesting paradox about the household as a private place. It is quite clear, for example, that the household is an exemplar of what we understand private places to be. Respect for privacy is strongly adhered to in conventions and behaviours of all kinds. Yet privacy cannot be understood as simply 'being oneself' but, on the contrary, involves a great deal of effort in constructing appearances 'for others', - that this device, this information, this room is 'private' - emphasising the importance of both 'privacy' and 'display' with regard to the home.

A more formal representation of this pattern is presented below. Note that there are links to more discursive fieldwork material that relates to the pattern presented in this page. There is also a thumbnail diagram of an outline description of an architectural solution that addresses the problem conveyed in this pattern.

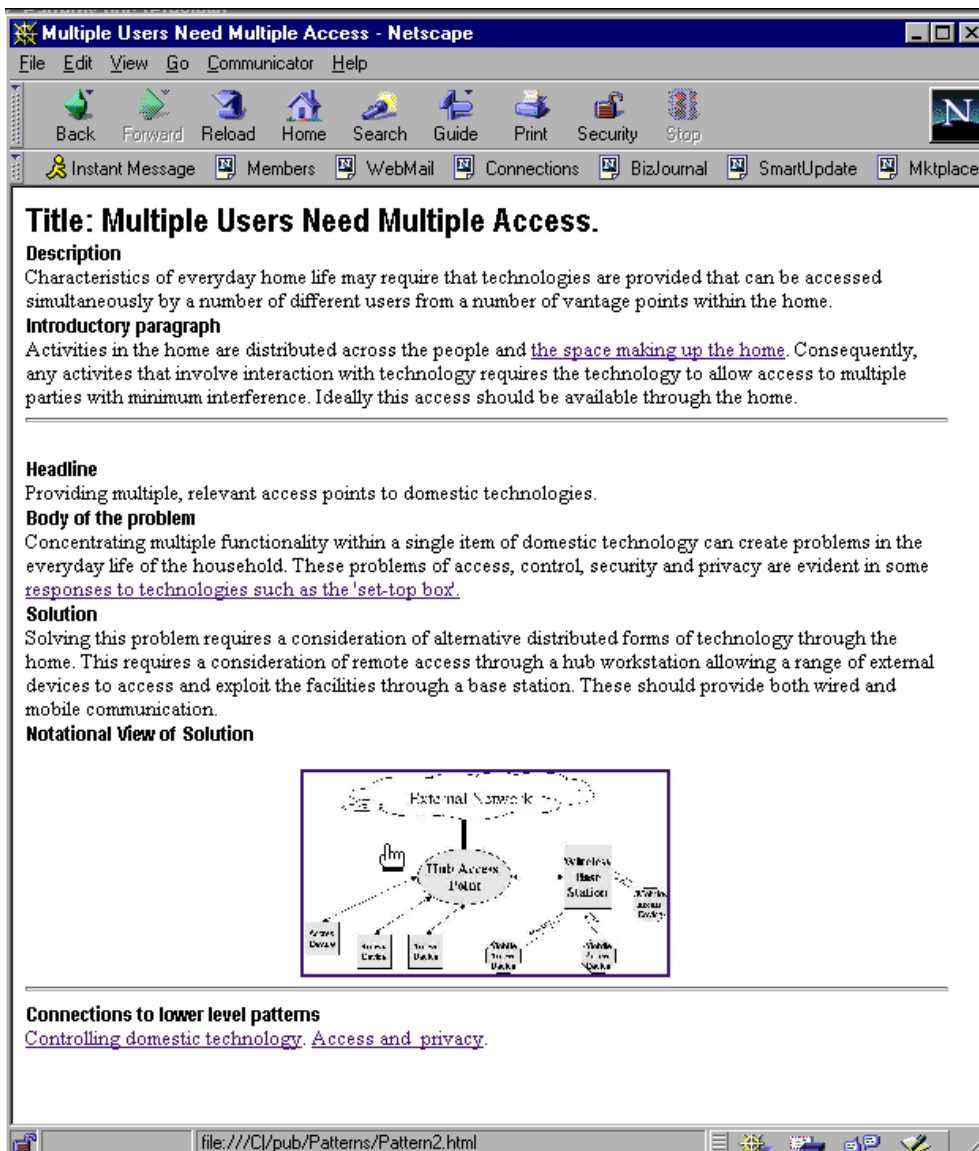


Figure 2: The Multiple Users Need Multiple Access Pattern

This pattern provides a strong focus on the interaction with the technology and the means by which the setting effects that interaction. However, the nature of the domestic environment is such that the setting is significant in terms of the placement and location of the technology within the home. In our second example we wish to focus on a pattern that conveys the more aesthetic issues involved in the placement of technology within the domestic environment.

6.2. Pattern 2: "Design for Temporary Beauty"

The second possible pattern we outline - "Design for Temporary Beauty"- is concerned with developing a pattern that facilitates the application of observable

and reportable aesthetic elements of homelife to the design of domestic technologies. The problem the pattern seeks to address is that of the aesthetic tailorability of domestic *technologies* in the same fashion and often with the same motivation as other aspects of the domestic environment so that 'a house' becomes 'a home' or 'a car' becomes 'chitty chitty bang bang', 'the silver beast' or whatever. Thus the technology becomes involved as an element of configuration and design in the construction of the home. Whilst this may appear trivial to those whose main focus is functionality, our studies have consistently documented the myriad ways in which houses were 'worked at' and made into 'homes' by various kinds of decoration and configuration. This work was characterised by its distinct and highly personal nature as we see in one householder's description of her front room;

F "I sit in there quite a lot now ... yeah I use it quite a lot and I had **really** set ideas about what I wanted. I wanted stripy wall paper and I wanted bookshelves in the recesses in the walls. I wanted a desk just like I've got and, you know, everything's been ... I knew what I wanted."

Although the different households in our study clearly had a range of financial resources to call upon in undertaking such 'home making' activities it was clear that the aesthetic nature of the house - the kinds of decoration, ornamentation and configuration that the house is subjected to in order to 'be home' - was of utmost importance. Such activities seem deeply rooted in our culture and are closely bound up with what Goffman [43] characterises as 'the presentation of self'. What we buy and how we arrange them in the domestic environment are statements about, for example, our 'taste', 'what kind of people we are', 'what kind of people we belong with', etc., and, accordingly, sources of inference for others about such matters. Such an attitude is already manifested with respect to existing domestic technologies and reflected, for example, in the massive variety of shapes, sizes, colours and configurations of hi-fi equipment and may well be extended to new domestic technologies.

This pattern is also more closely associated with the traditional views of patterns within architecture when they essentially consider the nature of the space and the sorts of activities afforded by particular spatial arrangements. As part of their descriptions these patterns describe the need for the space to support particular forms of neighbourhood and invoke particular sensitivities and feelings. A more structured representation of this pattern is presented below in figure 3. Notice here that the description of the pattern includes a photographic image drawn from the fieldwork that aims to act as a prompt in remembering this pattern. This pattern is also linked to patterns on the technology as aesthetic object and the robustness of devices. Notice also that, in this case, the link to the notational solution actually draws upon other on-line solutions by accessing the information provided by Philips Design in their vision of the future [44]

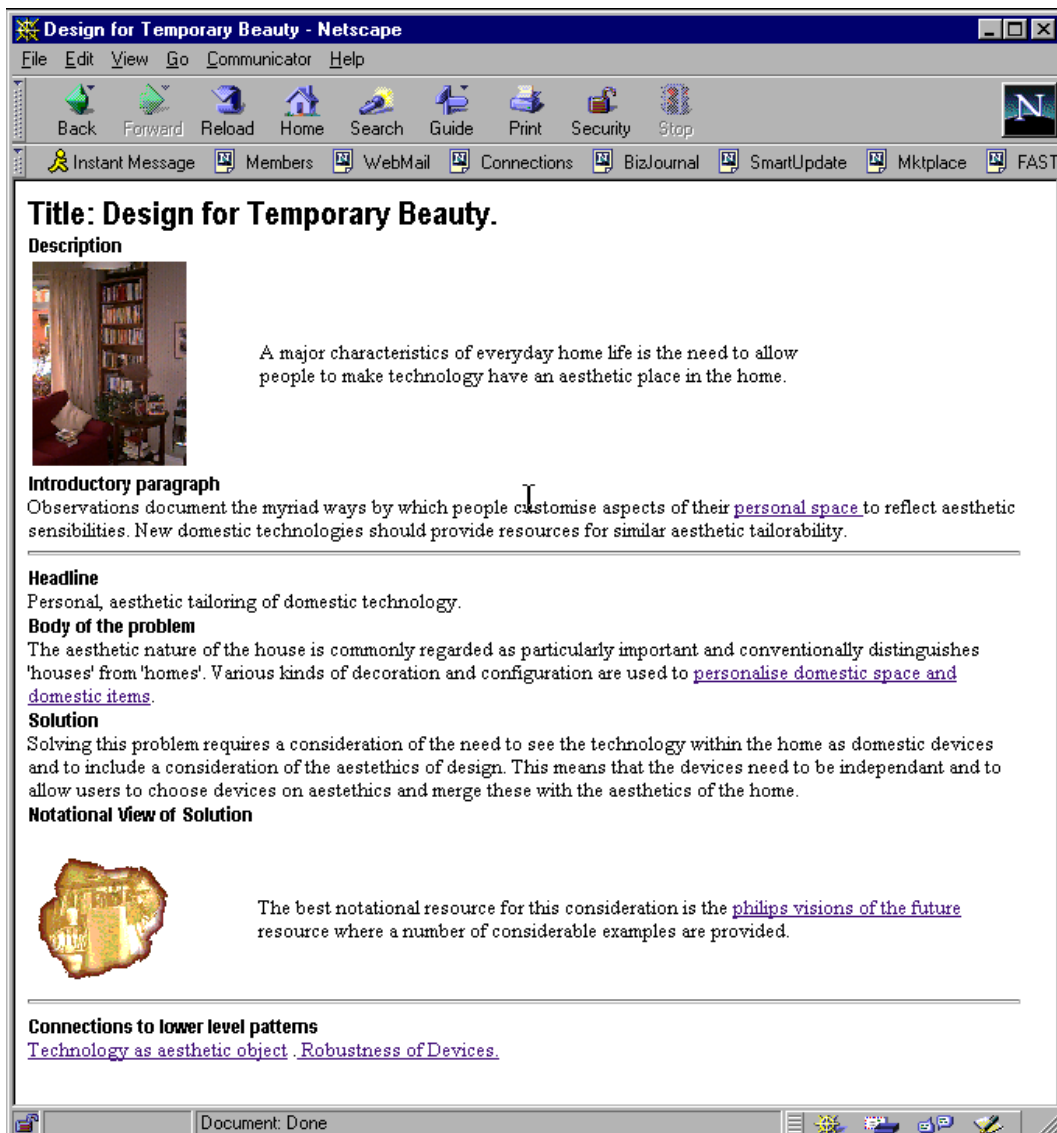


Figure 3: The Pattern for " Design for Temporary Beauty"

7. Conclusion

Social science techniques are widely accepted in the HCI and CSCW research communities but a major challenge remains in integrating these approaches with mainstream software development. We are addressing this challenge by drawing on our experience of ethnographic studies to develop techniques of social analysis that can be applied by engineers and business analysts rather than researchers or social scientists. Our initial work [45; 46] demonstrated that valuable insights could be gained from ethnographic studies. More recent work [Twidale et al

1993 [16]; Rodden et al 1994 [3] Hughes et al 1995 [15]] has built on these initial insights to propose new approaches to ethnography and the structuring of ethnographic material to make it more accessible by systems designers. The work outlined here represents a possible next stage in our long-term research agenda.

Our exploration of patterns of technologically mediated activity and interaction in domestic environments presented in this paper has allowed us to consider the potential of this approach as a means of presenting empirical work to developers of technology. In undertaking the construction of a pattern language within the overall domain of domestic environments we have been able to outline some preliminary and tentative answers to the questions we posed at the outset of this paper.

Do common patterns of interaction exist across a range of settings at a useful level of abstraction?

It seems clear that the everyday routine nature of domestic environments suggests that a familiarity exists and that there are potential patterns that may be identified as a resource for systems developers. However, it is also equally clear that the identification of these patterns is not easy. Our experiences confirm those of the members of the University of Brighton:

"(patterns) .. do not supply ready finished answers. People need to exercise their own creativity to implement a pattern.. patterns are hard to discover and may take a long time to describe adequately" [47]

This suggests that we need consider not only the initial development of a pattern but how they are used, modified and eventually become accepted as significant resources for design.

Can a 'pattern language' or template be developed that allows these different patterns to be documented?

Our exploration of the development of a patterns template for cooperative systems in domestic environments highlights the fact that there is no standard or agreed template for describing patterns. Certainly no such template exists for cooperative systems design. This raises the longer term issue as to how we may represent patterns to allow them to be readily understood by developers without considerable investment in learning a new or specialised notation.

While no standard pattern or template exists for the representation of patterns there is a growing trend to make these available online via the web. The use of HTML as a means of presenting this information has proven sufficiently flexible for the purpose while still providing facilities to allow the interconnection between patterns to be represented.

Can these patterns be used effectively in the context of studies of a variety of application domains for interactive systems development?

Our work to date has focused on the development of a base of patterns and the initial representation of these patterns using HTML. This has involved both ethnographers and developers and we have seen considerable debate in the

structure of the significant issues, the development of problems from these and the suggestion of solutions. Answering this question is obviously a long term endeavour and one that will require us to make the patterns more widely available.

Any developed patterns will seek to both inform analysis and support the development of design solutions by promoting communications between workplace analysts and system designers. Our current experiences in developing these patterns already suggest that patterns can be used in two ways.

- 1) The structure provided by the pattern acts purely as a means of presenting the results of studies
- 2) The structure provided by the pattern serves as an analytical device for those undertaking an investigation of environments.

These two distinct approaches essentially reflect a duality at the core of informing design from social science studies in that we need to move from descriptions of situations to specifications of design solutions.

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