

Pattern-based Support for Interactive Design in Domestic Settings

Designing for future domestic environments offers a challenge for everyone involved in the design of new technologies. The move from the office, and working environments in general, has highlighted the need for new techniques for understanding the home and conveying findings to technology developers. This paper presents a pattern-based approach informing the design of technology for future domestic settings. The approach is based on the original work of Alexander and seeks to support the on-going process of design, rather than the structuring of a corpus of previous work. The paper presents an adapted pattern language framework for structuring and presenting ethnographic fieldwork and considers the broad implications of patterns for the development of new technologies for domestic settings.

KEYWORDS

Domestic environment, ethnography, patterns of action and technology usage.

INTRODUCTION

The future domestic environment is currently receiving a great deal of attention from commercial and academic computing sectors as a place of design and IT development. A key research problem in

designing for this environment is to understand the everyday character of the home, how people live in the home, what they do when they are at home, and the potential role of technologies within the milieu of domestic activities.

With its early focus on business systems and office automation the IT community has developed a range of techniques to support design for the workplace. A variety

of techniques have emerged that promote an understanding of the nature of organizations and the different forms of interaction that underpin organizational life. A significant tradition in workplace design has emerged which has been open to considerable debate over the last three decades. When applied to the home, however, the workplace tradition appears to be inappropriate. Design approaches that have emerged from the workplace have, quite rightly, been grounded in the core rationalities of production, efficiency, the organization of labour, etc., but it is not at all clear that these rationalities transfer to domestic life.

Consequently, different researchers have exploited a number of alternate approaches to understanding the domestic environment in order to inform the development of new technologies for the home. These have most notably included longitudinal studies of the interactional dynamics of computer use in the home, which exploit quantitative techniques [26]; cultural probes that seek to analyze the motivations shaping home life, which draw upon art and design techniques [16]; and ethnographic studies of the socially organized, naturally occurring uses of technology in domestic interaction [40].

In this paper we wish to consider how to support the development of a broad under-

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standing of domestic interactions and technology uses and how these may be best made available to designers. Just as work-oriented design has been compelled to develop a broad understanding of the social character of work and organization [17, 19, 7], then so too the IT community is now under increasing pressure to develop a broad understanding of the social character of the domestic setting [30, 39, 21]. IT designers increasingly need to be aware of the social circumstances of technology usage in the domestic environment, especially of the everyday activities and interactions that shape technology usage in the home.

We contribute to the development of this broad understanding by using a pattern language framework to identify generic patterns of social action (i.e. interaction or action simply put) and embedded technology usage from the minutiae of ethnographic studies of the home. Over the last few years we have sought to exploit the basic principles of pattern languages to convey an understanding of the social organization of various settings [28, 21]. In this paper we build upon our initial experiences in using descriptive patterns to convey the sociality of technology use in the home.

Following success in software engineering [13], pattern language frameworks have been championed by members of the HCI community as a vehicle for sharing design solutions [3, 10, 12]. The main focus of existing patterns frameworks is essentially retrospective in character. The general aim has been to mine existing experiences in order to build a set of patterns that convey design problems and solutions to the wider community. Prescriptive solution-based patterns approaches have been complemented by descriptive patterns frameworks, which are concerned to illuminate, again retrospectively, work arrangements that commonly occur across a variety of settings, rather than design problems and solutions [11, 28]. These patterns frameworks form part of a broader pattern based approach to design where patterns are made available as a resource for design teams [18].

In this paper we extend the concern with descriptive frameworks by shifting from a retrospective outlook to consider a

prospective role for patterns in the design of interactive systems for the home. We are particularly interested in the use of pattern-based approaches as a means of structuring the on-going analysis of ethnographic material as part of an on-going process of design. Our aim, then, is not to re-examine previous ethnographic studies in the search for aggregated phenomena but to provide those undertaking ethnographic studies of the domestic environment with a structuring device allowing them to align their research with the broad needs of design.

Our turn to a descriptive patterns framework as a means of driving an on-going design process reflects the lack of a general understanding of the home and is informed by Alexander's original work where the commonsense notion of *place* was central to the structuring and presentation of patterns. Our use of such a framework is motivated by the appeal to and use of commonsense knowledge of patterns of action (or "typifications") in everyday design practice [37].

Typification is central to design and descriptive patterns may provide a useful typification device, conveying knowledge of day-to-day activities, interactions, and technology uses in the home. We address the role of typification in design and then (re)turn to consider salient features of Alexander's patterns framework [2] in order that we might identify important structural features shaping the development of an adapted framework capable of addressing the broad needs of design in a domestic context. Our adapted pattern language framework provides a means of structuring the results of ethnographic studies of the home and informing design by presenting findings in terms of patterns of action and technology usage. We provide an overview of an emergent set of patterns and discuss initial experiences in using patterns to drive the design of IT for future domestic settings.

THE RELEVANCE OF PATTERNS TO DESIGN

The pattern framework outlined in this paper aims to support the design process by providing a resource that conveys the key activities, interactions and technology uses in domestic settings. We take as our starting point previous work undertaken by

Sharrock and Anderson [37] concerning the theory and practice of design to outline the relevance of patterns to the design process.

Broadly speaking, design and development problems are "ill-structured problems" lacking definite criteria to test potential solutions [38]. Despite radical uncertainty, however, developers nonetheless manage to devise solutions. How do they *do* this, and do it recurrently, as a routine matter of day-to-day working practice?

Previous studies of engineering practice [6] suggest that the ill-structured problems that beset design are produced by developers in their conceptualisation of a "design space". How a developer conceives of the design space (e.g. the home), and the needs of users therein, depends upon his or her position and function in the division of labour (i.e. on his or her role, competence, and skills). Thus, each position in the division of labour (ethnography, software engineering, and HCI, say) brings a different conception of the design space to the table resulting in the production of an ill-structured problem of various layers of complexity.

Naturally, the heterogeneous design spaces constructed by the parties to development need to be aligned if the ill-structured character of the design problem is to be resolved. It will come as little surprise to say that alignment, and with that the formulation of concrete design solutions, is achieved through a locally organized process of "negotiation". What Sharrock and Anderson were interested in, and what is of relevance here, is how that local process of negotiation is organized by designers and, from our point of view, may therefore be supported.

The Commonsense Method of Typification

In order to answer the question Sharrock and Anderson consulted the work of design practitioners, studying how design spaces are constructed and aligned in actual working practice on the ground (in contrast to aligned in theory). Particular attention was paid to the ways in which users were and are constructed as a developers' object (i.e. as persons populating the design space who have distinct needs that technical solutions might be designed to

support). What is of interest in the authors' findings are not their comments on "the user" per se (i.e. some generic conceptual definition), but the *structure* of the work whereby reasonable, mutually intelligible and defensible constructions of "the user" and technically supportable needs were arrived at in practice.

Thus, and for instance, it might be suggested that the user might be a secretary, or a manager, or a key operator. Having designated these kinds of users, it was possible to introduce sets of expectations about what they might be trying to do, what they might know about the machine or process in question and how likely they were to initiate one or another sets of routines. In the terminology developed by Schutz [36], "secretary", "manager", "key operator" are *personal types* associated with which are constellations of roles and relationships. In addition to these personal types, our designers also deployed what Schutz calls *course of action types*. Here the defining characteristic is not social identity, gender, organizational position or role, but an envisageable course of action which is being undertaken. It was around what could reasonably be said about such courses of action that "the user" entered design decision making.

This finding, which is supported by other studies of design practice [35], indicates that analysis of the design space is structured or organized to some significant extent in terms of *typification*. Typification is a commonsense method of constructing shared understandings and, in a design context, of constructing an inter-subjective sense of user activities and needs amongst the various members of the division of labour in the actual course of getting the job of design done.

Typification and Patterns of Action

Typification essentially uses commonsense categories of social types – e.g. "secretary" – as a resource to reason about and identify the needs of the particular users that populate the design space. Commonsense categories of social types may be employed in this way as such categories are *tied to particular activities* or courses of action that define the social type invoked [34]. Thus, and for example, "policemen"

arrest and prosecute wrongdoers, "waiters" take orders for food and serve at your table, "secretaries" answer phones, arrange meetings, and record minutes, etc.

It may be noted that when considering the courses of action which define a social type, we are no longer considering an isolated individual but the actions of a generic other: policemen not a policeman, waiters not a waiter, secretaries not a secretary. The method of typification allows developers to identify generic needs of particular users then, under the commonly known auspices that "these" actions are tied to "this" type of user. Thus, analysis of the design space is rooted in commonsense knowledge of the typical courses of action that the particular social types populating the design space perform: in commonsense knowledge of *patterns of action* to be precise.

In using the commonsense method of typification and invoking commonsense categories of social types, developers employ common knowledge of patterns of action to construct a reasonable, mutually intelligible and defensible sense of "the user" and to formulate potential design solutions supporting the user's work. As Sharrock and Anderson put it,

The user is introduced into design through the use of typificatory structures. Our aim has been to show first that these structures conform to patterns and second that these patterns can be analysed using the concepts of personal and course of action types ... By invoking such typificatory structures, designers are able to construct the rationale for their design decisions within the flow of the designing. Seen from within the activity of design, in the midst of exploring the design space, these structures enable designers to construct their design worlds.

The appeal to and knowledge of patterns of action is *an integral part of design practice* – a naturally organized lingua franca underpinning the negotiation central to design, which presupposes the deployment of formal methods. With this point in mind we wish to consider the potential utility of a patterns framework as a means of supporting the design process. In the following section we consider the original

patterns framework before presenting an adapted version supporting the identification of patterns of action and technology usage in ethnographic studies of the home.

RETURNING TO ALEXANDER'S PATTERN LANGUAGE

Whether concerned with reusability in software engineering, or the cognitive or social organization of technology in use, the notion of a pattern language for design has its origins in the critique of architecture [5]. It specifically emerges from the work of the architect Christopher Alexander [1], who was fundamentally concerned to bring an awareness of the *use* of towns and buildings to bear on the discipline. The use of buildings necessarily involves social action and has parallels with our own concerns to understand the sociality of the domestic environment. It also suggests a need to return to Alexander's original conception of patterns rather than to rely on those inspired by the problem-solution focus of his work. In this section we reconsider the original work of Alexander and adapt his pattern framework to support analysis of the design space.

Alexander's foundational observation is that towns and buildings are organized through patterns of actions or "patterns of events" that people take part in over and over again. Being in bed, taking a shower, eating breakfast in the kitchen, sitting in the study writing, walking in the garden, cooking lunch, going to the movies, taking the family out to eat at a restaurant, having a drink at a friend's house, driving on the highway, and going to bed again are examples used by Alexander to illuminate the point. Our lives are organized through *reoccurring patterns* of work, leisure, travel, relaxation, and the rest.

Although patterns of action are implicated in the daily lives of individuals, a great many patterns are not individualistic but organize "our lives together" as members of society:

they are the rules through which our culture maintains itself, keeps itself alive, and it is by building our lives out of these patterns of events, that we are people of our culture.

Thus, and for example, each morning people get up, shower, eat breakfast, and drive down the highway to work, where

they together engage in other patterns of activities, such as checking their mail, attending meetings, or going for lunch, etc. A great many of the patterns whereby towns and buildings are organized are thoroughly social in character. In the first instance, then, patterns of actions make the *social organization* of towns and buildings visible.

The Essential Interrelation of Patterns and Places

In considering the sociality of towns and buildings Alexander also observes that patterns of action are *tied to particular places* within a society. So taking a shower in a morning is tied to the bathroom, eating breakfast to the kitchen, driving to work to the highway (and not the sidewalk), for example. As Alexander puts it, patterns are always “anchored in space”:

I cannot imagine any pattern without imagining a place where it is happening.

Furthermore, the patterns of actions out of which any particular place – a bathroom, a kitchen, a highway, etc. – is made up are “rather small” or finite and definitive, which provides for their generalization to other such places in a society. Thus, showering may be generalized to bathrooms, eating breakfast to kitchens, driving to highways, and so on. Alexander’s framework ties patterns of action to the architectural environments in which they naturally occur then, and provides a basis for designing future towns and buildings

The preliminary objective of pattern analysis in a domestic context is to identify the finite patterns of actions that are situated in and define particular places in the home: in kitchens, living rooms, studies, and the other sub-environments that taken together comprise the home as a whole. The primary objective of pattern analysis is to identify the patterns of relationships that obtain between patterns of actions and the material arrangements of place: between a person entering a building and the physical entrance, between people cooking and the physical layout of the kitchen, between people doing individual activities in a communal living room and the spatial characteristics of the room, etc. [2]. Placing analytic emphasis on *patterns of relationships*, Alexander draws our attention to the

reoccurring ways in which people interact with their architectural environment and, particularly, with the material arrangements that it is made up of. These patterns of relationships are the primary object of pattern analysis in Alexander’s framework. They elaborate the socially organized ways in which people *use* the material arrangements of place and the problems they encounter in the course of use.

Knowledge of these patterns and the problems they embody is made publicly available, along with proposed architectural solutions, through the use of a distinct presentation format, which Alexander describes in the following way:

First, there is a [pattern number, a title and a] picture, which shows an archetypal example of [a] pattern. Second, after the picture, each pattern has an introductory paragraph, which sets the context for the pattern, by explaining how it helps to complete certain larger patterns. Then there are three diamonds to mark the beginning of the problem. After the diamonds there is a headline, in bold type. This headline gives the essence of the problem in one or two sentences. After the headline comes the body of the problem. This is the longest section. It describes the empirical background of the pattern, the evidence for its validity, the range of different ways the pattern can be manifested in a building, and so on. Then, again in bold type, like the headline, is the solution – the heart of the pattern – which describes the field of physical and social relationships which are required to solve the stated problem, in the stated context. This solution is always stated in the form of an instruction – so that you know exactly what you need to do, to build the pattern. Then, after the solution, there is a diagram, which shows the solution in the form of a diagram, with labels to indicate its main components. After the diagram, another three diamonds, to show that the main body of the pattern is finished. And finally, after the diamonds there is a paragraph which ties the pattern to all those smaller patterns in the language which are need to complete this pattern, to embellish it, to fill it out.

In talking of “larger” patterns Alexander may be understood to be talking about the *primary* patterns that define place – e.g. making breakfast, lunch or dinner in the kitchen – and in talking of “smaller” patterns he may be understood to be talking about the *component* patterns that make up a primary pattern – e.g. getting foodstuffs from the refrigerator, implements from drawers, using the cooker or microwave, cleaning the table, etc.

While Alexander’s framework stands in need of adaptation to handle the interactional details of technology usage in the home, it is in this respect that we believe that an adapted patterns framework and presentation format might be of utility to design. Primary patterns might be understood to consist of domestic routines, through which household members structure day-to-day life in the home [30]. Component patterns might be understood to consist of the everyday activities that make up domestic routines. These phenomena are grossly observable and available to ethnographic study. Combined with an appropriate patterns framework, ethnographic studies might, then, illuminate patterns of action and technological relationships in the home and support the commonsense method of typification that underpins analysis of the design space and the formulation of design solutions.

Adapting the Framework

The original framework might be readily adapted to meet the needs of design by extending the notion of the material arrangements of place to include technology. In doing this, we construe technology in the *broad sense* of the word to include such things as the humble pen and paper, tables, noticeboards, windows and doors, etc., as well as sophisticated computing systems. As Venkatesh and Nicosia [41] put it, we need to look at a whole range of technologies in the home no matter how mundane,

[for] in order to understand the adoption/use issues of computers, one must view the total technological space of the household ... very little insights will be gained by looking at computers alone.

Thus, and for example, in the course of making breakfast certain pragmatic day-to-

day patterns of relationships involving kettles, toasters, microwaves, radios, TVs, newspapers, and the rest, become apparent. From this simple example it is evident that the patterns of relationships revealed by the adapted framework will consist of *patterns of action and technology usage*. We take the explication of these patterns to be the goal of pattern analysis in a design context for a number of interrelated reasons.

- They elaborate in real world, real time details of interaction what people do in the home.
- In such detail, they serve to make visible the social organization of domestic technologies-in-context (in the kitchen, living room, study, and in

1. Patterns of action make the social organization of towns and buildings available. (Alexander)
2. Patterns of action are tied to particular places within a society. (Alexander)
3. The patterns of action out of which any particular place is made up are finite and definitive. (Alexander)
4. The finite and definitive character of patterns of action provides for their generalization. (Alexander)
5. The primary aim of pattern analysis is to identify the patterns of relationships that obtain between patterns of action and the material arrangements of place. (Alexander)
6. The notion of material arrangements of place may be extended to include technologies, broadly construed. (Adaptation)
7. Patterns of relationships reveal patterns of technology usage. (Adaptation)
8. Patterns of technology usage make the social organization of domestic technologies-in-context visible. (Adaptation)
9. Patterns of technology usage make unsupported use practices available to the design of future technological arrangements of place.

Table 1. Core elements of the adapted framework

the making of dinner, entertaining guests, or doing schoolwork, etc.).

- They ground design in actual courses of action or use practices that are currently unsupported by computing technology.

The core features of the adapted pattern language framework are illustrated in the Table 1.

APPLYING THE ADAPTED FRAMEWORK

It is one thing to theorize the characteristics of patterns and to suggest that patterns can provide an analytical orientation for understanding domestic settings. It is another to draw upon ethnographic data in order to identify patterns as real world, real time features of the domestic setting. How, it might be asked, are real world patterns of activities to be found or located and how are we to explicate and make visible the patterns of relationships that bind domestic activities and technology together?

Finding Real World Patterns in Domestic Routines

In undertaking studies of the home we are particularly concerned to locate the work implicated in the routine construction of domestic life. The construction of domestic routines enables household members to coordinate and conduct their daily activities in an orderly rather than a haphazard way. In getting up in a morning, household members may take the same routine turns in using the bathroom for example, ensuring that they each get to work on time. Routines are distributed around the various sub-environments that comprise the home and interwoven with the use of technology [30]. The technologies of the bathroom (showers, razors, toothbrushes, etc.) and the kitchen (toasters, kettles, radios, etc.) are implicated in daily routines of getting up and getting ready for work, for example. In this respect it might be said that routines articulate large or primary patterns of action that define particular places within the home, each of which is composed of smaller component patterns. Our first task is to locate these patterns, but how?

Alexander's methodology is inadequate for the task as it lacks empirical veracity [4], so we have employed "video ethnography" [42] to locate patterns of action. Specially

adapted digital cameras were placed in sixteen volunteer households and used to record everyday domestic interaction. Several key sub-environments (the kitchen, living room, children's bedroom, and study where available) were "wired up" to facilitate continuous video and audio recording and constitute the locus of our current inquiries. Up to five miniature, low-light, variable focus, remote cameras and video recorders were installed in each of the key areas and up to eight hours of video footage per day, per camera installation, was recorded. Recording equipment was installed in each of the households for a minimum of ten consecutive days per year over two-years. Camera positions and appropriate times for recording were decided following discussions with the families in their homes and with their agreement.

The volunteer families came from a range of socio-economic brackets in the UK, although neither exceptionally poor nor wealthy families were included in the study (as none volunteered). The result of the "video ethnography" resulted in the capture of some 6000 hours of household activity, which is free from intrusion and bias to a remarkable degree¹. All but one of the families conducted their affairs without undue concern as to the presence of the video, being concerned to get their activities done rather than worry about what was going onto the video. In practical day-to-day details of "getting activities done", video ethnography furnishes investigators with fine-grained and phenomenally intact in vivo recordings of everyday family life. In contrast to a mass of notes, anecdotes, vignettes, and disembodied conversations which characterize traditional ethnography, video footage becomes the primary resource enabling direct investigation of the domain.

Importantly, and in the manner of Sacks' [33] concern with audio recordings, video has the virtue that it is a "good enough" record of what actually happens in the home (and elsewhere), it can be replayed and so it can be studied in an extended way over a period of time, and others can

¹ It is not our intention to subject the entire corpus to patterns analysis, only to demonstrate the viability of the approach and provide materials to inform our own design work.

look at what the researcher studies and make of it what they will should they disagree with the findings. Not only can the researcher inspect the domestic environment in interactional details of actual activities being done, then, anyone else can go and see whether what is said about those activities by the analyst is actually so; and that, as Sacks reminds us,

is a tremendous control on seeing whether one is learning anything.

Identifying Patterns in the Fieldwork

The methodological approach we take to explicating patterns from the video footage is descriptive rather than theoretical in character. In other words, and for sound reasons of social research [11], we do not apply the pre-configured categories of some theoretical framework to codify the video data and detect patterns, but instead furnish “thick descriptions” [32] of the routine activities that occur in the particular places under study.

Thick description stands in contrast to “thin description”, signifying the difference between mere behavioral accounts that describe only what can literally be seen and those characteristics which identify action as the practical action it recognizably is for members. As Ryle [32] puts it,

[The] thinnest description of what the person is doing, e.g. pencilling a line or dot on paper ... requires a thickening, often a multiple thickening, of a perfectly specific kind before it amounts to an account of what the person is trying to accomplish, e.g. design a new rigging for a yacht.

1. Attend to and describe the grossly observable layer of talk on the videotape as it is hearably produced by the parties to it.
2. Describe the work done by members' in the course of making conversational formulations.
3. Describe the work-practices organizing members' work.
4. Describe the patterns of technology usage made visible by members' work-practices.

Table 2. Core procedures for identifying patterns

In order to get beyond the thinnest level of description of what members' are doing we are obliged to *thicken* the thin features captured on tape (audio and video alike) and we may do this by attending to and describing the following observable phenomena, which are implicated in the production and recognition of meaningful courses of practical action.

The prima facie phenomenon made available by the molecular sequences of interaction on an audio or videotape is a *grossly observable layer of talk* and, more specifically, a layer of conversational formulations over the unfolding course of which members articulate what it is that they are doing, what event is going on, or what practical project or course of action they are together engaged in here and now. This grossly observable layer of formulations constitutes the starting point for thick description of the practical courses of action occurring on the tape. The analyst's first task is to describe those conversational formulations as they are hearably produced and recognized by parties to the talk (as questions, answers, objections, challenges, agreements, and the rest). While special methods of description may be employed [e.g. 22, 23] they are not required as formulations do not, in themselves, display the social organized ways in which courses of actions come to assume the recognizable character that they do for members [14].

In order to explicate the meaningful character of discrete courses of practical action, the analyst needs to describe *the work performed* by members in making formulations. This is a feature of naturally occurring interaction that is partially eclipsed through the use of specialized methods of description, which focus on the way in which members' organize their formulations through various “turn-taking” mechanisms at the expense of the work *done* by members in taking-turns [15, 27]. Description of the work performed by members in making formulations makes the work-practices whereby members organize their work visible. These practices give the work its recognizable character [8] and their description elaborates distinct *patterns of technology usage*. The main methodological procedures for identifying patterns of action and technology usage are summarized in Table 2.

It should be noted that the notion of thick description is not to be taken as a claim to have furnished a complete and exhaustive description of all the factors implicated in technology usage in the home. There is a possibility to extend any description, infinitely [32], and so a child psychologist may extract very different findings from the video data than parties conducting pattern analysis, for example. Being concerned with socially organized patterns of action and technology usage (rather than psychological processes etc.), we believe that description of the phenomena outlined above are practically adequate however, as they serve to make visible just how and with just what *material technologies* domestic routines (reoccurring patterns of action) are “put together” and organized in the real world, real time interactions of household members. These descriptive practices are embedded in the adapted patterns format, which researchers may “fill in” to identify patterns in their own data and to present findings to other researchers.

Presenting Patterns of Domestic Life

The main purpose of identifying patterns of action and technology usage is to allow them to be used as part of an on-going design process. In contrast, to the work of Alexander we are not identifying problems or proposing solutions for some unknown future designer. Rather, we are making the real world, real time sociality of the domestic setting available to a multidisciplinary design team. This shift in orientation has required us to return to the original pattern language suggested by Alexander and alter it to reflect our new purpose.

New pattern languages have emerged for a wide variety of domains. Each pattern language has tended to reflect the specialized demands of its particular domain of utility. By returning to the original pattern language suggest by Alexander we wish to build upon the commonsense notion of place as a means of structuring ethnographic studies of routine activities, interactions and technology uses that occur in the particular sub-environments that make up the home and as a means of presenting findings to designers.

This section presents the pattern language used to structure and present findings of patterns that occur in particular sub-environments. We articulate the pattern

language through the presentation of a particular example showing how ethnographic data may be organized with a view to explicating patterns of action and technology use.

The adapted patterns format is web-based rather than text-based, which not only allows for the greater dissemination of findings but allows much richer resources to be provided to design than can be contained in a text. Using web technology, the “archetypal picture” may be replaced with actual video footage that displays the pattern in

question. The video may be viewed via a hyperlink embedded in the pattern’s title (Figure 1). The title consists of a common-sense description (e.g. “making breakfast”, “doing homework”, “assembling for dinner”, etc.). Given the analytic emphasis placed on patterns of technology usage, a sub-heading key technologies is added to the format, listing keywords that describe the technologies used in the video sequence (e.g. TV, mobile phone, microwave, kitchen table, etc.).

The “introductory paragraph” is renamed *interactional setting of the pattern* (Figure 2) This section briefly describes a) where the pattern occurs (e.g. in a small kitchen in family home); b) who is involved in the sequence of interaction (e.g. one adult female and her young daughter); c) what the parties to the interaction are doing (e.g. cleaning the kitchen); and d) the primary pattern this pattern is a component of (e.g. doing domestic chores).

Rather than explain how the pattern “helps to complete certain larger patterns”, hyperlinks in this section connect the pattern to a primary patterns log. This provides access to the corpus of component patterns making up the particular primary pattern in question. The job of “explanation” is done, then, by locating the pattern with its family members, each of which may be viewed online by the researcher.

The “essence of the problem” is renamed the *organizational context of the pattern* (Figure 3) and provides a formal summary of the practical issue addressed by the pattern.

The “body of the problem” is renamed *the work of the pattern* (Figure 4) and describes the routine activities that make up the pattern. The work is summed up in a synopsis.

The synopsis is followed by a transcript of the talk and description of relevant non-verbal practical actions of the parties to the interaction (Figure 5). The length of the sequence is specified by time marks at the beginning and end of the transcript. Partially audible conversational formulations are placed in square brackets or marked as [inaudible].

Rather than having a “solution” as part of our pattern language we seek to offer an account of the practices taking place. Consequently, the solution part of the original pattern structure is replaced by *the practices ordering the work of the pattern* (Figure 6), which highlights the recognizable social practices implicated in the work’s routine accomplishment. This section describes the familiar, recurring ways in which routine activities (such as cleaning the kitchen, doing schoolwork, handling the mail, etc.) “get done”. Description of these reoccurring practices provides for the identification of the pattern.

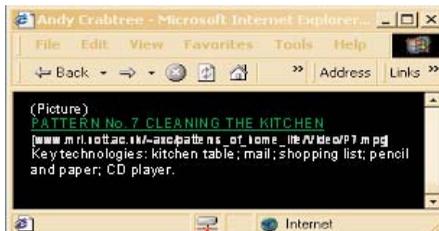


Figure 1: The pattern title

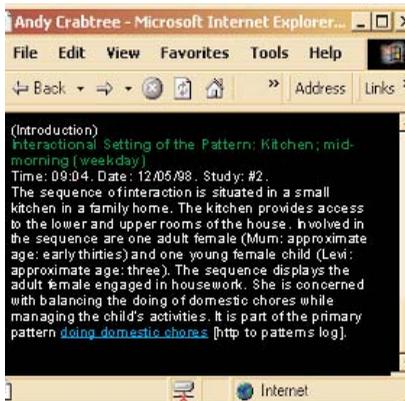


Figure 2: Interactional setting of the pattern



Figure 3: The organizational context

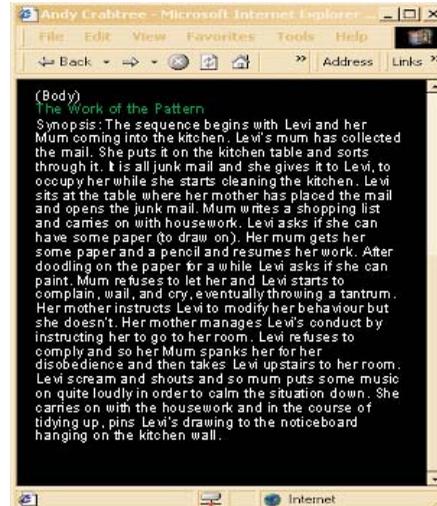


Figure 4: The work of the pattern

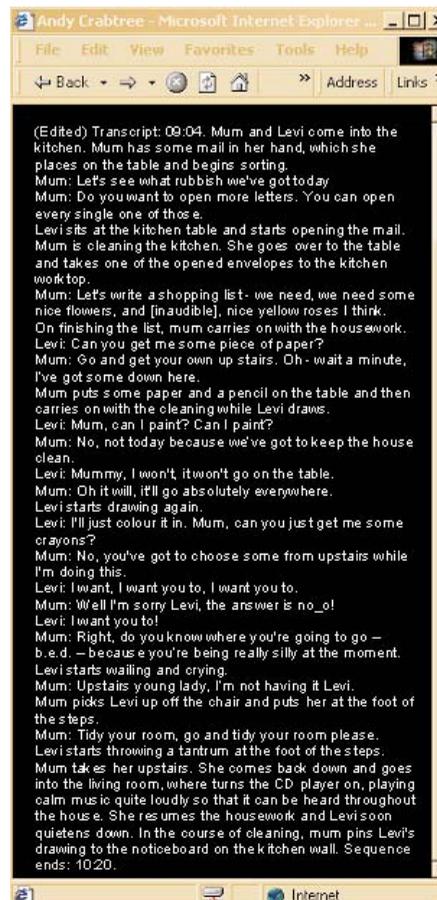


Figure 5: A transcript of the talk

The “diagram” is replaced with a more appropriate category to the task at hand, namely *the pattern of technology usage* (Figure 7). This section of the format describes the technologies used in the sequence of action as elaborated by the work and the practiced ways in which that work is organized. It is placed above *the work of pattern* because of its prima facie relevance to design.

The “tying paragraph” is renamed *connected patterns* (Figure 8) and uses hyperlinks to connect the pattern to a *patterns index*, which provides access to other patterns that use the same key technologies.

Connected patterns elaborate the bricolage of patterns of action that revolve around particular technologies and connect particular technologies together in a place. The bricolage of patterns elaborates potential

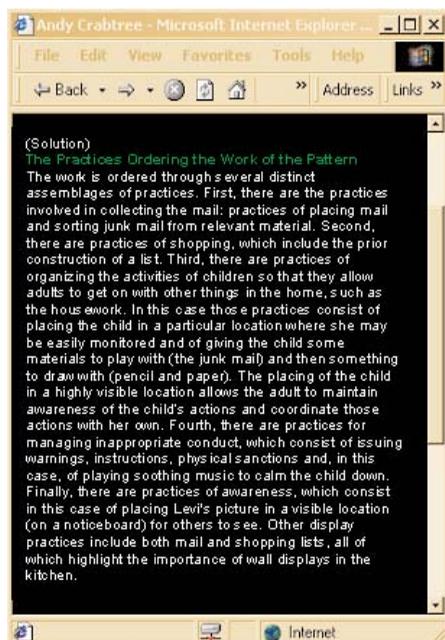


Figure 6: The practices ordering the work of the pattern

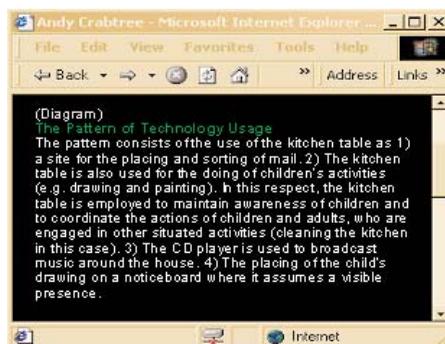


Figure 7: The pattern of technology usage

application areas for the design of new technologies.

PATTERN SUPPORTED DESIGN FOR THE HOME

The previous sections have argued for a shift in the nature of patterns from a structuring mechanism where previous solutions or descriptions are aggregated to allow information to be stored for future use. Instead, we suggest that given the lack of general features and principles to underpin design for domestic environments, patterns can instead be used to inform an ongoing process of design. Consequently, this paper has focused on how an analytical orientation to patterns can be used to structure ethnographic data and present findings to drive analysis of the design space. In this section we wish to briefly review our initial experiences of the use of the adapted patterns framework when considering the design of technologies for the home. Rather, than provide a specific instance of design we outline broad reflections on the utility of the approach.

Legacy Issues

Perhaps the strongest initial benefit of patterns is as a means of sensitizing designers to the lived reality of domestic life. The adapted patterns framework shows us that the home is a complex technical domain. It may lack sophisticated computing technologies but is nonetheless a technical arena for all that and this insight has important implications for the design of domestic technologies generally.

The patterns framework informs us that the home is an evolving social institution whose technical organization is bound to the quotidian needs of its inhabitants. However, the everyday character of technology usage in the home sits uncomfortably with a great deal of current research, which seeks to devise revolutionary solutions under the auspices of the “smart home”.

This means that little attention is paid to the current use of technologies in the home. Indeed such an exercise may well be eschewed as the home will (we are told) be utterly transformed in the future. There is no need, then, to attend to the here and now as it will be transcended in design [24]. With that, the day-to-day needs that *motivate* the incorporation of technology into the home are ignored, and to the detriment

of design rather than the everyday lives of home dwellers. The success or failure of technological innovations depends on their responding to and adding value to the current historically constituted needs of domestic life [25], which suggests a clear need to adopt *a legacy perspective* towards design for the home.

Adopting a legacy perspective means that developers are compelled to get to grips with the requirements of future technologies by addressing *the constraints of the present and the past*. These constraints routinely manifest themselves within an organizational context, where legacy issues are important to consider when implementing new systems [20]. Importantly, the constraints placed on legacy systems are not purely technical in character. Whatever technical characteristics computers may possess, they are irremediably embedded in an organizational context, which is essentially social in character [31]. The home is no exception to this, being a socially organized setting regardless of its non-commercial character [40]. When considering the domestic legacy we are required not only to attend to the technical organization of the home then, but also to the ways in which technology is socially organized and woven into the fabric of daily life [30].

The adapted patterns framework sensitizes design to the social fabric of domestic life through the explication of patterns of action and technology usage that comprise the domestic legacy. Attending to routine activities in the home, the adapted framework provides the opportunity to identify discrete application areas for the design of novel technologies that resonate with members’ use practices and so supports the construction of the future on top of the present [29].

Elaborating the Design Space

Patterns support the elaboration of the design space through the identification of discrete application areas. Discrete application areas are identified via the organization of patterns in the patterns index. The patterns index makes collections of patterns visible, with each collection displaying a *bricolage of patterns* that coalesce around particular technologies in the home. Collections emerge from the structuring of ethnographic studies in terms

of place and through the connection of patterns that employ the same technology within a place (such as the kitchen).

The coalescence of patterns around particular technologies draws attention to important sites for design in the home. The emergent or self-explicating structure of patterns surrounding the kitchen table (Figure 9), for example, draws our attention to the significance of the kitchen table as a multifunctional technology at the heart of domestic life.

The Design Space Surrounding the Kitchen Table

The set of empirical patterns of use surrounding the kitchen table illustrates the way in which a pattern approach serves to elaborate the design space. What these patterns serve to do is emphasize that the kitchen table assumes far more practical significance in domestic affairs than being

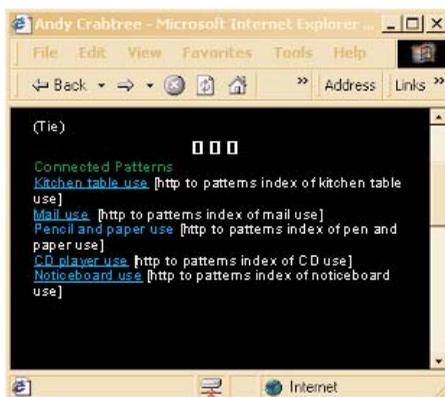


Figure 8: Connected patterns

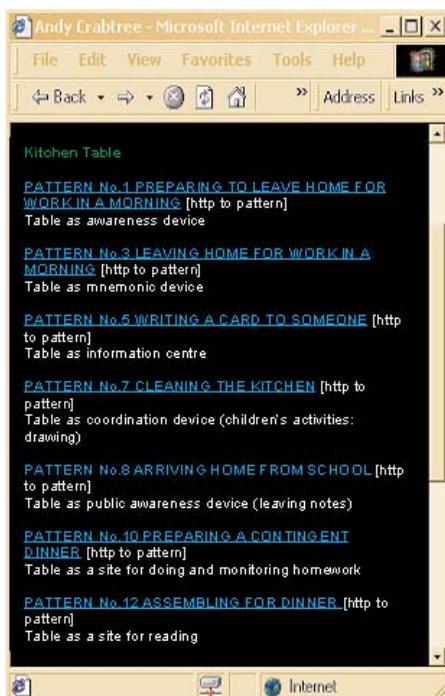


Figure 9: A pattern index

an important place to eat meals and socialize [24]. The bricolage of patterns informs us that the kitchen table is an **activity centre** around which a great many patterns of use revolve. These patterns inform us that the kitchen table has a number of important uses in the management of the everyday activities and interactions in the home.

- It is used as an *awareness centre* where people place things they are required to take along with them when they leave the home.
- It is used as a *coordination centre* where adults may monitor the doing of schoolwork by children and as a site where young children may be occupied (doing drawing, crayoning, painting, etc.) and monitored while adults get on with domestic chores.
- It is used as an *internal communication centre* where mail is sorted and displayed to household members and where notes are written and displayed.
- It is used as a *shared information production and management centre* where shopping lists are constructed, bills are processed, account books and ledgers updated, etc.

Indeed, it is used for a host of practical activities that are completely unsupported by current computer-based technologies in the home.

Other patterns in the kitchen inform us that the design space is larger than we might initially believe as the kitchen table, to continue with the example, is also *connected in action* to a range of other technologies: to noticeboards, calendars, diaries, etc., which raises the possibility of developing distributed systems, devices and displays in the kitchen and around the home. And if such systems and displays are developed, what of interacting with them via mobile devices from outside the home to further augment awareness, coordination, communication, and shared information production and management in the home?

As this brief example hopefully demonstrates (as there are limits to what can be shown in a short paper) the adapted patterns framework serves to sensitize us to the patterns of practical actions and

technology usage that occur in and define particular places. It provides empirical resources which designers may use to support their reasoning about what “typically” goes on in particular places and, in considering the bricolage of patterns that coalesce around particular technologies therein, to identify potential application areas for design. Furthermore, in preserving the interaction whereby patterns are produced, patterns may be used to formulate and sketch out initial design solutions.

If we were to try to develop support for email use in the home, for example, then patterns of physical mail use inform us that certain generic interactional practices are at work that may be usefully drawn upon in design: mail is collected at a central point, sorted and irrelevant material disposed of, mail for other people is visibly displayed, and once opened it may well be placed on a noticeboard or placed on a pending pile thereby maintaining awareness of some action to be taken, for example. As this commonly known example indicates, patterns may work as resources for design in some very familiar ways, supporting the commonsense method of typification that underpins analysis of the design space. And in preserving the details of interaction, patterns also provide concrete empirical resources supporting more technical practices of scenario construction.

CONCLUSION

The needs of the home are poorly understood and approaches are still being developed to convey a broad understanding of the home to designers. We have seen specific ethnographic studies [9, 30], cultural probes [16], and the use of patterns to structure existing studies of domestic environments [21]. Although some models of technology in the home have been elaborated, most notably by Venkatesh [41], the area lacks the broad set of approaches and techniques that have emerged to support the development of IT in the workplace.

The broad frameworks that have emerged in workplace design, which emphasize organizational structure, process, workflow and task, for example, and which provide general conceptual structures for analyzing the design space and organizing design work, are not easily transferable to the domestic setting however, as the home is not characterized by such formal features.

This is not to say that there is nothing to be learnt from workplace design. Legacy issues are as prominent in the workplace as they are in the home and as our analysis of domestic interaction elaborates, certain design concepts informing workplace design are relevant to understanding the domestic setting. The concepts of awareness and coordination, derived from Computer Supported Cooperative Work, are as relevant to understanding the home as they are to work and may serve to guide design in the domestic environment as they have in the workplace. The relevance of workplace design concepts to the analysis of the domestic design space is not an *a priori* matter, however, but a matter of close and careful inspection and analysis of domestic life.

The adapted patterns framework has served to elaborate several broad design concepts that may usefully be oriented to when inspecting and analyzing the domestic design space. In addition to awareness and coordination these also include internal communication, and shared information production and management. Just what these concepts consist of in detail has been, and may continue to be, elaborated through the identification of patterns of action and technology usage in the home. In other words, if we are to support shared information production and management in the home, say, then we might proceed by identifying patterns of action and technology usage whereby shared information is produced and managed by household members in various *places* around the home.

The adapted patterns framework provides a socially oriented approach to inspecting and analyzing the home and provides techniques for structuring ethnographic studies to identify patterns of action and technology usage from within the milieu of domestic activities. The identification of these patterns supports analysis of the domestic design space via the common-sense method of typification, elaborating what people typically do in the home, where, and how. Furthermore, the coalescence of patterns around particular technologies in the home supports the formulation of design solutions supporting the day-to-day needs of inhabitants. A small collection of kitchen patterns has been assembled to support our own design activities and is available as a public demonstration:

www.mrl.nott.ac.uk/~axc/homepage/fieldwork.htm

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