Patterns of Technology Usage in the Home: Domestic Legacy and Design

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ABSTRACT

Pattern language frameworks are of increasing interest to human-computer interaction. Previous work has largely concentrated on the potential utility of patterns as a means of understanding the social and interactional context of technology usage. In this paper we cover untouched ground in the patterns debate, addressing how patterns might be found or uncovered. We do so in the context of the domestic environment, which is currently receiving a great deal of attention and whose needs are poorly understood. As in the workplace, design for the home will rely on an appreciation of the socially organized ways in which domestic technologies are woven into the fabric of daily life. We suggest that a pattern language framework will serve to make this legacy an available resource to designers. Accordingly, we present a methodological framework that grounds design in the socially organized patterns of technology usage that exist in the home.

Keywords

Home, domestic legacy, patterns of technology usage, ethnography, ethnomethodological studies of work.

INTRODUCTION

Pattern language frameworks are of growing interest to the designers of interactive systems. In the HCI community, patterns have been construed of as a means of understanding the social/interactional context of technology usage [e.g. 4, 9]. In this paper we cover previously untouched ground in the patterns debate, addressing how patterns might be uncovered and made available by designers. We articulate the pattern language framework in the context of the domestic environment, whose needs are poorly understood.

The domestic environment is currently receiving a great deal of attention from commercial and academic computing sectors. Increasingly, a large number of researchers are actively considering the design and development of devices

appropriate for the home [e.g. 3, 20, 24]. A fundamental research problem in designing for the domestic environment is to understand the everyday nature of homes and how people live in them, in order that designers might be able to identify the potential role of technology and develop appropriate solutions. Different researchers have exploited a number of approaches towards understanding the domestic environment and articulating needs. These include ethnographic studies [25], cultural probes [14] and longitudinal studies of computer use [21]. However, there is at present something of a discontinuity between studies of domestic environments and the development of new technologies.

At the center of the discontinuity stands a predominant technology-driven perspective, which seeks to devise radical solutions revolutionizing the home. Approaches which adopt this perspective typically place emphasis upon what the needs of the home of the future might be expected to consist of given current technological possibilities [18]. Thus, design is all too often concerned with prospective needs identified through considerations of technological innovations and trends, rather than with needs identified through considerations of technical arrangements of the home as it stands in the here and now as a historically constituted fact of life. Alternately it might be said that technology-driven approaches run the very serious risk of ignoring the "domestic legacy" and, consequently, of developing solutions that are incompatible with the practical day-to-day circumstances of use.

The home is not a modern phenomenon but an ancient social institution whose technical organization is bound to the historically evolving needs of its inhabitants [5]. The technical arrangement of the home changes gradually over time, then, to meet the quotidian needs of residents. With this social legacy in mind, we suggest that rather than ignore the developing day-to-day needs of household members, design should instead strive to build upon the domestic legacy and not least for the reason that future technologies will inevitably be answerable to it [23]. Indeed, the success or failure of technological innovations for the home might be seen to rest on their fitting into and adding value to the current historically constituted needs of domestic life [19].

In this paper we present a unique research programme we have developed for understanding the everyday nature of the domestic legacy in order to inform technological development. Our approach extends previous work on *Architectural Patterns* [1, 2, 4, 9, 15, 18] It provides a framework within which, and techniques and methods through which, designers may extend current considerations to encompass existing arrangements of technologies in the home. We describe the framework and discuss its use in the analysis of a corpus of video material drawn from an extensive study of domestic environments. We illustrate something of the framework's utility in presenting an example which describes the design of a multifunctional device for the home.

THE LEGACY OF THE DOMESTIC

Adopting a legacy perspective towards design 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 organizational systems and we believe it is necessary to adopt a similar perspective in considering development for the domestic environment. 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 [26]. The home is no exception to this, being a socially organized setting regardless of its non-commercial character [29]. 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 [25]. The point to be appreciated here is that, as in the workplace, the social organization of technology in the home will elaborate constraints and requirements of technology usage in the future [30].

Addressing domestic legacy issues is a both and practical and methodological problem. How are designers to explicate the social organization of domestic technologies and make that organization available to their consideration? Workplace study methods appear to be highly inappropriate for the task as the products of domestic life – i.e. people - are exceptionally valuable and their rationalities of production, efficiencies, labour costs, material needs, and the rest, cannot be adequately appreciated in terms of workplace criteria. Developments in evaluating the use of buildings in architecture seem more promising and have attracted considerable attention in a design context of late [4, 9, 15]. At the heart of the matter lies the notion of a "pattern language" [2]. Below we briefly address the architectural notion of patterns and our own adaptation of that notion to include the social organization of domestic technologies. We place particular emphasis on *patterns of technology usage*.

Using Pattern Language Frameworks to Convey Legacy

Pattern languages for design have their origins in architecture's efforts to reconstruct itself by taking the adaptation/use of towns and buildings into account [5]. It specifically emerges from the work of the architect Christopher Alexander [1]. Alexander observes that towns and buildings are organized through reoccurring "patterns of events" that people take part in over and over again. Being in bed; having a shower; having breakfast in the kitchen; cooking and eating a common lunch; going to the movies; taking the family to eat at a restaurant; having a drink at a friend's house; driving on the freeway; and going to bed again are examples used by Alexander to illuminate the point. Although such patterns of events are implicated in the daily lives and practical actions 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. [2] (p. 69)

For example, each morning people get up, shower, eat breakfast, and drive down the freeway to work, where they together engage in other patterns of events, such as checking their mail, attending meetings, or going for lunch, etc. A great many of the patterns of events whereby towns and buildings are organized are thoroughly *social* in character then. Thus, patterns of events make available the social organization of towns and buildings.

As a matter of ordinary social convention, patterns of events are *tied to particular places* within a society. So, for instance, having a shower is tied to the bathroom, eating breakfast to the kitchen, driving to the freeway (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. (ibid.)

Furthermore, the number of patterns of events out of which any particular place – a bathroom, a kitchen, a freeway, etc. – is made up are "rather small" or finite.

The preliminary objective of pattern analysis is to identify the finite patterns of events 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, thereby providing a rich empirical portrait of the social organization of domestic technologies-in-context. Identifying patterns of events is not the primary focus of pattern analysis, however, but the starting point for the explication of the domestic legacy.

Situating Technology in a Pattern Language Framework

The primary objective of pattern analysis is to identify the socially organized *patterns of relationships* that obtain between patterns of events and the material arrangements of place: between cars and pedestrians crossing the road, between persons entering a building and the physical

entrance, between people doing individual activities in a communal living room, etc. [2].

We extend the notion of material arrangements of place to include technologies, which we construe of in the *broad sense* of the word to include such things as the humble pen and paper, tables, noticeboards, etc., as well as sophisticated computing systems. As Venkatesh and Nicosia [31] 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. (p. 527)

So, for example, in the course of "making breakfast" certain pragmatic day-to-day patterns of relationships become apparent and make technologically-mediated organizations of domestic life involving kettles, toasters, microwaves, radios, TVs, newspapers, and the rest, available to design. From this it follows that patterns of relationships reveal *patterns of technology usage*. We take the explication of these patterns to be the goal of pattern analysis for design as they make the real world, real time social organization of domestic technologies-in-context (be they in the kitchen, living room, study, and in the making of dinner, entertaining guests, or doing schoolwork, etc.) available to designers considerations of future technological arrangements of place. Table 1 illustrates the core features of the adapted pattern language framework.

1. Towns and buildings are organized through reoccurring patterns of events that people take part in over and over again and which define architectural space (as an "office", "shop", "park", "home", etc. (Alexander)
2. Patterns of events are social and thus make the social organization of the home-building available. (Alexander)
3. Patterns of events are tied to particular places (to kitchens, bathrooms, etc.). (Alexander)
4. The patterns of events out of which any particular place is made up are finite. (Alexander)
5. The finite and architecturally-bounded character of patterns of events provides for their generalization. (Alexander)
6. The aim of pattern analysis is to identify the patterns of relationships that obtain between patterns of events and the material arrangements of place. (Alexander)
7. The notion of material arrangements of place may be extended to include technologies, broadly construed. (Adaptation)
8. Patterns of relationships make patterns of technology usage visible. (Adaptation)
9. Patterns of technology usage make the real world, real time social organization of domestic technologies-in-context available to consideration in the design of future technological arrangements of place. (Adaptation)

Table 1. Core elements of the pattern language framework

APPLYING THE PATTERN LANGUAGE FRAMEWORK

It is one thing to theorize the characteristics of patterns, another to identify them as real world, real time features of the domestic legacy. How, it might be asked, are real world patterns of events to be found or located and how are we to explicate and make visible the patterns of relationships that bind domestic events and technology together in real time?

Originally developed for the needs of architecture, Alexander's observational framework is not adequate for the task. One potential solution is articulated by Venkatesh [30]. Accepting an ethnographic approach to the study of "actual patterns of use", we have certain reservations regarding the analytic emphasis placed on the sociological functions of technology by the household/technology model however.

We are specifically concerned with the substitution of members' formulations of meaning for analytic formulations of functional value. As Venkatesh and Nicosia [31] quite rightly point out

> technologies are not passive objects in the technological space, they are live, full of meanings for the members … who use them. (p. 523)

The meanings members attach to technologies drive adoption and shape use. The use of desktop computers in the home, for example, is motivated and regulated by the meanings members' attach to it. The computer may be an "educational" or "communication" tool or something that the kids "waste time" on. It is not that the computer either assumes one of these meanings or the other but rather, at different times in the course of the different events that occasion its use (doing homework, sending an email to a friend, playing games, etc.), the computer assumes all of these meanings and is thus woven into the milieu of domestic activities [25].

Members come to adopt technology and organize its use through the meanings *they* attach to it in the course of conducting their daily affairs then. Consequently, it seems to us, that analytic attention ought to be paid to members' formulations of meaning rather than be substituted for professionally defensible accounts that gloss over the real world, real time social organization of technology usage.

Locating Real World Patterns of Events

Rather than develop a model of the home we prefer instead to conduct (through ethnographic inquiry) ethno-methodological studies of work [11, 7]. While it may appear strange to talk of studying "work" in the home, we do so in the sense that domestic environment is a site characterized by ongoing practical activity: getting up and ready for work in a morning; taking the children to school; receiving guests; making dinner; doing schoolwork; and all the other mundane socially organized events that "go on" in and "make up" the domestic environment. The work that takes place in the home is part and parcel of and elaborates the domestic legacy and design should, therefore, attempt to be responsive to that work as technologies will in various ways be embedded within the socially organized activities of the home and their use be constrained by them.

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: 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 [25]. In this respect it might be said that *routines articulate large or primary patterns of events* that define particular places within the home, each of which is composed of smaller component patterns. The purpose of study is to locate the primary patterns that occur in various sub-environments and to assemble a "base map" making patterns of technology usage available to design [1].

Pattern Analysis: Video Ethnography

In our own work we have located patterns of events through "video ethnography" [32]. 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, 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 degree. 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.

In both practical and procedural terms family members provided invaluable help. In many respects household members acted as adjunct researchers, determining when and where observations should be made. A member of each family was nominated "technical assistant" in order that the quality of the video could be monitored and that tapes could be changed daily. As the location of cameras was determined by members' intimate "insider" knowledge of the setting, then so too, in their capacity as technical assistants, members' decided on appropriate times for scheduling recording. In addition to these activities, each household took part in individual and family wide interviews and viewings to explore ambiguities in the recordings and foster our understanding of their daily activities. Thus, in situations where the meaning of domestic activities was unclear, clarity was established through collaborative examination of the video materials in question.

Importantly, and in the manner of Sacks' [28] 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 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 lived events, then, anyone else can go and see whether what is said about those events by the analyst is actually so; and that, as Sacks reminds us,

> is a tremendous control on seeing whether one is learning anything. (p. 26)

Identifying Real Time Patterns of Technology Usage

The approach we take to "learning anything" or explicating patterns from the video footage is descriptive rather than theoretical in character. Specifically, we seek to furnish "thick descriptions" of the actual interactional events that have been recorded [27]. Thick description stands in contrast to "thin description", signifying the difference between mere behavioural 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 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. (p. 10)

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 "accomplishment levels" (ibid.) implicated in the production and recognition of meaningful practical action.

The *prima facie* accomplishment level 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 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 actions that are 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. 16, 17] they are not required as formulations do not, in themselves, display the local orders of work through which practical actions come to assume the recognizable character that they do for members [10].

In order to explicate the meaningful character of practical action, the analyst need attend to a second accomplishment level and describe **the work performed** by members' 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 [22, 12]. Describing the work performed through members' formulations makes available for description a third accomplishment level, which consists of **the reoccurring courses of practical action** or the "work-practices" whereby members order their work and which furnish the work its recognizable character [6]. A fourth and final accomplishment level is made available by members' work-practices, namely **the patterns of technology usage** made visible by the reoccurring courses of practical action through which members' order their work so that it comes to assume its recognizable character time and time again: as practical actions implicated in "making breakfast", "doing schoolwork", "entertaining guests", "watching TV", and all of the rest. The main methodological procedures for identifying patterns are summarized in Table 2.

1. Attend to the grossly observable layer of conversational formulations on the videotape.
2. Describe the work performed by members' formulations.
3. Describe the reoccurring courses of practical action or "work-practices" whereby members order the work.
4. Explicate the patterns of technology usage made visible by the reoccurring courses of practical action through which members' order their work.

Table 2. Core procedures for identifying patterns

It should be noted that the notion of thick description of accomplishment levels is not to be taken as a claim to have furnished a complete and exhaustive description of all the factors implicated in the adoption and use of technology. As Ryle [27] reminds us,

> there is no top step on the stairway of accomplishment levels (p. 4)

There is, then, a possibility to extend any description, infinitely. A child psychologist may extract very different findings from patterns of events than parties conducting a social/interactional and technological analysis, for example. Being concerned with socially organized patterns of technology usage (rather than psychological processes etc.), we believe that description of the four orders of accomplishment level 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 events) are "put together" or constructed in the real world, real time actions of members. Thick description of these accomplishment levels are adequate, then, as they make available for consideration in design the real world, real time interaction and concomitant patterns of technology usage glossed over and missed by analytic accounts that substitute members' formulations of meaning for professionally defensible ones.

The Kitchen Table: An Example Pattern

This compact methodological account might be more readily appreciated by practical example. Consider the following molecular sequence of interaction drawn from an instance in which a mother is situated in a kitchen with her small child.

1. Conversational Formulations in the Kitchen

The mother of a young child (age three approx.) is cleaning the kitchen. She sits the child (Levi) at the kitchen table and gives her some junk mail to open.
Mum: Look, you've left your apple.
Levi is grumbling unintelligibly.
Mum: Stop making all that noise.
Levi: Will you get me some piece of paper?
Levi: Will you get me some piece of paper?
Levi: Will you get me some piece of paper?
Mum: Go and get your own up stairs.
Levi: No, I want you to get me some.
Mum: Oh wait a minute, I've got some down here.
Mum puts a couple of sheets of paper on the table along with a pencil. Levi picks the pencil up and starts drawing on the paper. Mum carries on with the housework.
Levi: Can I paint?
Levi: Can I paint?
Mum: No, not today 'cause we've got to keep the house clean.
Levi: I want to paint.
Mum: Not today.

2. The Work Performed by the Formulations

This uncomplicated interactional sequence begins with mum issuing a mild admonishment to Levi for not eating the apple she has been given. Levi responds in grumbling in an annoying childish way, which her mum instructs her to stop. Levi complies with the request and soon after asks in a very insistent way for some paper. Her mum instructs her to go and get her own paper but Levi refuses to comply, demanding that her mother to get her some paper instead. Mum notices some paper close to hand and passes it to Levi along with a pencil. After drawing quietly for a few minutes while mum gets on with the housework, Levi makes a request to paint, which is denied.

3. The Work-Practices Ordering the Work

The work is ordered, as one might expect given the age of Levi, through several rudimentary practices. Levi is 1) sat at the table and given something to occupy her in order that mum can get on with the housework. Levi soon tires of the junk mail and 2) makes a request of her mum to get her some paper. Mum 3) turns down the request and Levi 4) restates it. Mum 5) complies with request and hands Levi some sheets of paper and a pencil. Levi starts 6) doodling while mum carries on with housework. Levi then 7) makes another request this time to paint, which is 8) denied. The work is basically ordered through issuing and responding to a series of rudimentary requests, a technique of interaction that many three-year old children have mastered.

4. The Pattern of Technology Usage

Although unexceptional and very unsophisticated, this simple molecular sequence of interaction makes a commonplace pattern of technology usage visible. The kitchen table is a technology in the home and one *used as an activity center*. More specifically, the kitchen table is a device *employed to coordinate activities* in the home. In the case above the table is used to coordinate the actions of mother and child, being employed as an appropriate location to do drawing, and on other occasions, painting while mum gets on with cleaning the kitchen. Importantly, in this respect, the placing of the child at the kitchen table allows mum to monitor the child and so *maintain awareness* of the child while doing the housework.

Coordination and awareness are integral features of various patterns of table usage in the kitchen. Other sequences of routine interaction make different patterns of table usage available. In a similar manner to the pattern above, the table is used a site for monitoring children and coordinating their activities with those of adults working in the kitchen. This time, however, the table is implicated in the playing of games by children who use it in a tent-like fashion as a site to conduct their activities (including drawing). Other patterns show that tables are used to display new mail that requires attention and action to household members, for example. Once read, mail may be placed on a noticeboard or some similar visible location in the kitchen, maintaining members awareness of things that need to be done. Similarly, the table may be used as conspicuous site for the placing of objects required by household members for the day's activities. Alternatively, the table is often used for doing schoolwork, enabling parents to assist, coordinate, and monitor the actions of children. Or again, as a site for coordinating the management of household accounts.

To summarize, the table is an activity center around which many patterns of usage revolve, which raises the issue of devising appropriate coordination and awareness technologies that center on and around the kitchen table; be it on the surface of the table (supporting drawing, painting, writing, etc.), on the floor (supporting the playing of children's games, for example) or on the kitchen walls (supporting awareness of things to be done, etc). These varied yet interrelated locations of work elaborated by the bricolage of patterns that take place in particular sub-environments, and around particular technologies, suggest the need for flexible solutions layered with different, situationally relevant functionalities. In this way, we might devise solutions "built upon" existing technologies and practices in the home, which support a wide variety of day-to-day activities, in contrast to single uses.

PATTERNS AND DESIGN

The pattern-based approach to analysis seeks to provide a method which allows a closer link with design and the domestic setting to be forged. By attending to the molecular sequences of interaction that take place in and across the various sub-environments of the home, and which latch together to make up the home as whole, a corpus of empirical patterns may be assembled locating design in the everyday patterns of socially organized events and technology usages that comprise the domestic legacy. In addition, the development of a common format for the presentation of patterns will enable the sharing of patterns across various "work" domains within a culture and across cultures [2, 8]. Insofar as patterns are identified in and across other domains, and in other cultures, there exists the possibility of identifying empirically, and without reduction, "ubiquitous" patterns of technology usage. That is, patterns that make sense across a variety of domains [9] and across cultures even.

In the context of software engineering, patterns assume a prescriptive significance, directing the work of design [13]. We use the pattern framework as a means of articulating requirements for future technologies. This means that patterns work as a resource with designers may use to think about development and use to ground design in the lived day-to-day realities of domestic life. Employed as a valuable resource rather than a prescription for design, patterns play two roles or functions in the design process. Firstly, they *identify discrete domains for design*. In our own work to date, these include: household management, security, awareness and coordination, education, and children's activities. We have no doubt that as our investigations proceed further domains will be identified.

Secondly, patterns work as resources for design in some very familiar ways, being easily assimilable into design practice in supporting *the construction of scenarios* and the articulation of technologies to meet the demands of these scenarios. As an example, consider the pattern provided in the previous section. As part of our work we have sought to design a technological arrangement that is sensitive to the core needs of patterns of kitchen table usage. As previously illustrated, a central feature of kitchen table patterns is the role of the surface as a location for the coordination of activity. Children may use the table for drawing or painting on, for example, and adults for doing household accounts. The located or situated character of the surface in interaction is a significant feature of many patterns of table usage and the surface therefore plays an important everyday role in the routine work of the home. At the same

time, however, activities that take place on the table are connected to other discrete technologies and locations. Children may play on the floor under and around the table; adults move mail from the table and put it on noticeboards on the kitchen wall. The challenge for design, then, is how to provide technology which is sensitive to this legacy and which can be readily interwoven with the routine work of the home?

Designing Devices for Domestic Legacy: An Example

In design context, we have addressed the legacy issues raised by patterns of technology usage by considering how we might develop technological arrangements that can be readily configured to augment existing surfaces and spaces. Rather than develop a completely new and expensive table that incorporates digital technology with limited functionality, we take the view that the design challenge is one of **augmenting the existing environment** with relatively inexpensive multi-purpose, multi-functional technologies. Instead of implementing radical changes to the environment, the shift to augmentation allows us to layer new functionality on top of the existing domestic legacy and aims to support a gradual evolutionary process of change by users.

Given the pattern of events and technology usage described above, we have designed and prototyped a device that allows users to make existing surfaces interactive. This novel device takes the form of a portable projector which can be moved freely around the home. The projector has an associated Mimio device (http://www.mimio.com) that allows existing surfaces to be made interactive (Figure 1).
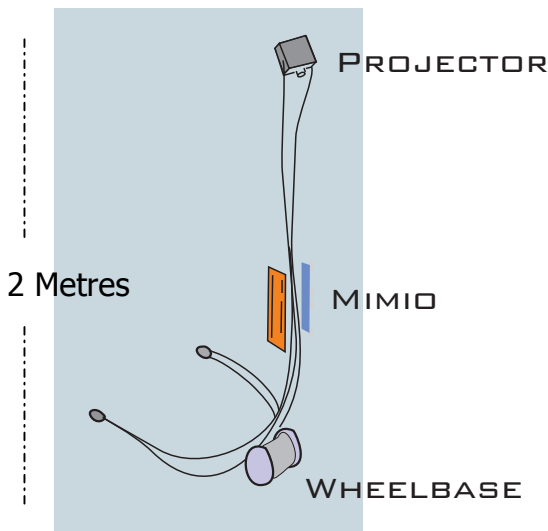

Figure 1. The interactive projector

This device seeks only to augment existing surfaces and exploit the legacy inherent within them. It builds upon the kitchen table's place within the domestic setting rather than replaces it with a revolutionary product. The device is designed to be portable and to be readily configurable to add interaction to a range of different surfaces including floors and walls (Figure 2).
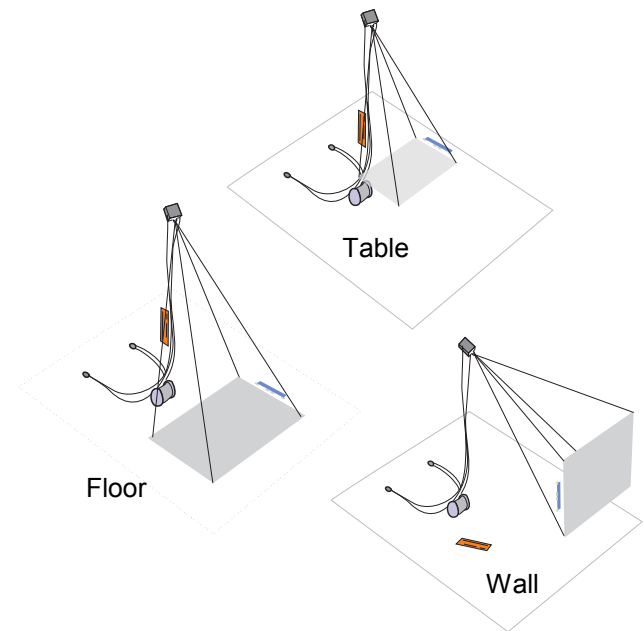

Figure 2. Different arrangements of the projector

Being sensitive to the domestic legacy, the projector represents a different class of device for the home. Existing information appliances are largely self-contained artifacts to be added to the home. These include such things as electronic noticeboards, smart fridges, electronic picture frames, and a range of other limited use, self-contained devices. By way of contrast, the projector builds upon the domestic legacy by supporting existing practices which bind places and artifacts together in the home. The projector makes sense within the context of the activities that routinely occur at and around the kitchen table and may be extended to provide functionality elsewhere in the home. In this way, our pattern language framework supports designer's efforts to augment the day-to-day lives of inhabitants.

CONCLUSION

In this paper we have presented an adapted pattern language framework to foster our understanding of domestic environments. This research programme may also be undertaken in a range of other domains. We have developed an uncomplicated set of methodological procedures to support the identification of patterns of events and technology usages. We continue to apply this approach to a corpus of video data drawn from a range of domestic settings. As part of our ongoing work we are developing a range of devices based on existing patterns of technology usage in the home. Being sensitive to the notion of domestic legacy, these devices are designed to augment domestic arrangements rather than revolutionize them.

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