

The Resourcefulness of Everyday Design

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ABSTRACT

We discuss our study that looks at family members as everyday designers. We explain the design actions of family members to be creative, as evidenced by the resourceful appropriation of artifacts and surroundings, the ongoing adaptation of systems and routines through design-in-use that allows emergent properties to arise and addresses individual needs, and how implicit understanding and explicit tests occur for judging quality. We present a preliminary analysis of design implications in the area of interaction design in the home. Our findings are based on a five-month ethnographic study of three families.

Author Keywords

Design-in-use, everyday design, ethnography, pattern language, home, domestic, creativity, family.

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

The aim of the study reported in this paper is to describe and explain the actions of family members as everyday designers. In this discussion, we focus on the role of creativity in everyday design actions. We are examining a form of creativity that we all take part in and one that helps us negotiate our daily lives. We describe creativity as resourceful and adaptive actions that lead to unique design situations and systems.

The promise of ubiquitous computing has led to recent design interest in interactions in the home. Current design ethnography suggest the home is a set of organizational systems and routines in which designers should consider evolutionary solutions [6]. Artifacts and actions in the home

are utilized by being made visible or pliable – they are seen as resources for further action [4, 12, 16]. Contributing to this previous research, we argue that this view strongly suggests the ongoing presence of *designers* in the home. We see home dwellers as a type of everyday designer who remakes or modifies systems, and who uses design artifacts and actions around them as design and creative resources.

This paper asks if families are designers, how do they design? In answering this question, we discuss in depth our study and observations. In order to provide some context we begin with an introduction to design ethnography. We conclude with a discussion of the findings and import to design of our study.

We believe that our study contributes a descriptive understanding of the role of design in everyday routines and systems. We aim to explicate patterns of interactions as being creative and design oriented in the context of the family and the home. Below we provide a summary of our contributions to this area of research:

1. Descriptions of the *appropriation* of artifacts and surroundings as design resources. The simplest of such acts discover and exploit *affordances* [11] between situations, people and the physical environment. By *appropriation*, we mean the remaking of something through a use that becomes personal, framed within our understanding of our situation and our anticipated future [10]. This often involves shifting the original intent of a design or making general affordances more specific. Simple appropriations can also be at the center of ongoing routines. Further, a diverse set of such uses can form a *system* within the home that could be for organization, communication, or whatever other needs exist. Such a system is *pliable* (can be altered) and *artful* (diverse yet specific to unique needs) [16]. We hope to add a descriptive layer to the theoretical notions of crossing the boundary between production and use as described by Suchman [15] and Alexander's *unselfconscious process* [1] in which a design system maintains equilibrium through constant actions over time, or *piecemeal building*.
2. Descriptions of the dynamic nature of everyday routines, artifacts and interactions, in which the importance of *design-in-use* of systems is central. We

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begin to understand that systems can coalesce into a form but are always subject to change through the catalytic pressures of use and individual actions. This presents a challenge to current technology design that is founded on the production of finalized forms and understandings of use as static and individual.

3. Explanation of creativity as being at the heart of the response to supporting dynamic everyday routines and different interests and needs across the family. In particular, we explain how *resourcefulness*, the creative re-use of artifacts and the physical surroundings, is a building block for everyday design. We also explain how *adaptation*, the shaping of systems by individual use and history of use leads to augmentation, critique, and or positive change that evolve systems to better address unique needs.
4. Explanation of implicit effects and explicit actions that help judge the quality and success of a system. We describe an implicit effect in which the whole is greater than the *awareness* of the sum of the parts, and an explicit action of testing- in-use.

We conclude that everyday designers continually shape systems to respond to specific needs and settings by creatively appropriating artifacts and the surroundings. We feel that interaction design needs to consider designed artifacts in the home as creative *resources* for everyday designers.

DESIGN ETHNOGRAPHY

Ethnography is both a methodology and a field of study. As a form of anthropology its aim is to create holistic descriptions of cultures and peoples. Design ethnography is an emerging practice that draws heavily on anthropology theories and methods (as well as other social sciences) [13]. Design ethnography shares with ethnography the reliance on “participant observation” in which ethnographers learn by participating in and observing social routines and interactions. Design ethnography is distinct from ethnography in that the aim is not to create holistic representations of entire cultures or subgroups, rather the focus is on generating accounts of specific social activities and interactions in which design is present within the observed interplay of artifacts, people and contexts. We have employed ethnographic techniques and an ethnographic approach to understanding the observed phenomena.

Recognition of the social dimension of interactive systems design has increased the use of ethnographic techniques in Human-computer interaction (HCI) and Computer-Supported Cooperative Work (CSCW). Suchman demonstrated the clear efficacy of applying ethnographic techniques to design [14]. Discussion has ensued on the specifics of how best to apply ethnography to technology design [3, 5]. Recent studies have utilized design ethnography in trying to understand the home and the role

ubiquitous computing might have in aiding domestic routines [6].

In our study, we utilize pattern language as a representational and analytical tool. Pattern language is one method design ethnographers have used to formalize observations [6, 9]. The origin of pattern language lies in the work of the architect Christopher Alexander [2]. Alexander analysed patterns of relationships in the ways in which people interact with their architectural environments. Patterns aim to elaborate how we have socially organized architectural solutions over time and through use. Patterns offer interactive system designers a flexible means of representing design solutions. Often, pattern language is adapted to fit the domain at hand. In design ethnography, these adaptations include emphasis of the descriptive rather than the prescriptive roles of patterns, descriptions of actions and routines, and a focus on artifacts in a domestic context rather than strictly architecture [6].

OUR STUDY

Our study included three families with young children ranging in age from 5-13 years old. The parents were professionals (elementary and high school teachers and a legal aid worker) ranging from early to established in their careers. The families included a married couple and two mothers with live-in partners (one parent was divorced with joint-custody of her child). All three families were from the same neighborhood, were friends, and interacted regularly with each other. The study occurred over a five-month period, and included over 350 hours of observations and interviews. We used three ethnographers, each assigned to one family.

The aim of this study is to describe everyday design in which design is a form of use. We see families as a type of everyday designer who remakes or modifies systems, and who use design artifacts and actions around them as design resources. This type of design activity is an everyday cycle of interaction and adaptation that occurs over time and evolves design systems, artifacts and routines [18].

The design ethnography study was structured into three sequences: 1) developing a relationship with participants with the aim of the ethnographer shifting along the continuum from an observer to a participant; 2) focused data collection, looking for design related routines and activities; 3) directed open-ended interviews and video walkthroughs aimed at members of the families explaining targeted routines, actions, and artifacts. After the preparatory phase we developed a pattern language that was iterated upon throughout the study. Our process revolved around *sessions*. A session is a single visit by an ethnographer (typical sessions were 1 to 3 hours in length). Ethnographers participated in 3-4 sessions a week.

OUR PATTERN LANGUAGE

Based on our gathered data and analysis, we created a working pattern language for our study that included fifty

related patterns. We organized the pattern language into conceptual categories: *environment*, *systems*, *activities*, and *artifacts*. While there are other ways the patterns could have been organized this gave us a primary structure that allowed us to group similar patterns together. Generally, our approach to the structure of the working pattern language was identical to Alexander [2].

Of the fifty patterns, not all were relevant to our focus on everyday design. In fact most were not, the majority of our patterns served as a systematic way to establish observed patterns first. We then refined our pattern language to select those with important design attributes. A significantly smaller number of patterns actually directly describe everyday design.

EXAMPLES FROM THE HOMES

From our observations, we present several of the patterns that illuminate aspects of everyday design and especially the role of creativity in the appropriation and re-use of design artifacts, the adaptation to the contingent nature of routines and systems in the home, and the approaches to determining the quality of a given system. We have clustered our observations of participants' actions into three groups: *resourcefulness*, *adaptation*, and *quality*.

Resourcefulness

We encountered many examples of families' appropriating artifacts in their environments and putting them to new and expedient purposes. In certain cases, expediency gave way to integrating actions and artifacts into ongoing routines and systems. In the examples below, we observed how family members were resourceful in their use of artifacts and physical surroundings.

Hanging Jackets on Chairs

The pattern, *Hanging jackets on chairs* characterizes a set of recurring observations of the repurposing of artifacts. The significance of the pattern is that readily available artifacts are used temporarily in a manner different than their original intent. For example, as the pattern name suggests, we often hang jackets on the backs of chairs. While such uses are viable in the short term they are typically less so in the long term, i.e. a chair would not function well as an ongoing coat rack. Another example can be found in Cate's home, where Paul (Cate's partner) would set his keys, jacket and gloves on the kitchen table when he arrived. He would later gather up his items before leaving. Cate is an art and theater teacher in high school. She has joint custody of her ten-year-old son. Paul divides his time between Cate's home and his own home.

One session in Lori's home occurred a day after her birthday. Lori is a part-time primary school teacher, who lives with her five-year-old son and during the time of our study, a live in partner named Abe. During the ethnography session Lori received a bouquet of flowers from her friends. She looked in the kitchen cupboards for a vase. She pulled out a measuring cup and a vase that contained marbles. She



Figure 1 A measuring cup is used to temporarily hold marbles to free up a vase. The marbles and measuring cup are placed visibly atop the fridge to serve as a later reminder to find a better place for the marbles

emptied the vase pouring the marbles into the measuring cup. The vase was now free to use for the flowers. Lori put the bouquet of flowers in the vase and the measuring cup full of marbles on top of the fridge (see Figure 1). Placing the marble-filled measuring cup on the fridge rather than back in the cupboards served as a reminder that when time is available, she would need to find a better place for the marbles in order to make the measuring cup available for use again.

During a session with Ryan and Janis, the family was gardening in the backyard. Ryan is a high school social sciences teacher. Janis is a legal aid worker. They have two sons, age eight and ten, and a daughter age thirteen. We observed that two plastic lawn chairs served as ready-to-use tables. On one chair, a coffee cup rested on the seat. Nearer to the far end of the yard, on another lawn chair was another coffee cup on the armrest, along with a newspaper, toys, and phone on the seat (see Figure 2)

The examples above are simple actions of appropriating artifacts by discovering and exploiting the affordances, such as the flat surfaces of the chairs, or container qualities of the measuring cup.



Figure 2 Two lawn chairs used as temporary garden tables

Making use of the half wall

Similar to the previous pattern, *Making use of the half wall* is another pattern of re-use. The significance of this pattern is finding a use or new use for a structure in the environment. For example, each house in our study contained half-height walls. The tops of these walls were almost always put to use, if only by temporarily resting items on it.

Timmie (Ryan and Janis' eight-year old son) was always concerned with cleaning and organizing the house. Despite being unable to naturally reach the upper cabinets in the kitchen, he found a way around this problem. For example, when Timmie emptied the dishwasher, he would remove the dishes and pile like items together on the counter. He would then pull open the lower cupboard door and use the shelf in the cupboard as a step to climb on to the counter (see Figure 3). He would then kneel on the counter, open the upper cupboard door, and place the stacked dishes inside. He would then climb down, remove more dishes from the dishwasher, and repeat the process.

Children were not the only ones to utilize a structural resource. During a session, Cate thought we'd be interested in her use of the half-height wall in the kitchen. She explained that she moved things from the kitchen table (she dubbed the table the 'kitchen desk' due to its multi-purpose use) to the top of the half-height wall. In this instance, sewing items and material were on the top of the wall. In an earlier session the same items and material were on the table. Cate explained that when she or others in the house switched from one activity to another that used the kitchen table, items used in the first activity often end up on the kitchen half-height wall. We later identified a pattern of identifiable piles that surrounded the table area resulting from different kitchen table activities.¹

The last two examples show how resourceful use of artifacts and environments can become routine, that is more integral to daily life than the expedient and temporary uses illustrated earlier. We were also able to trace how expedient and routine use can evolve into an ongoing system of organization. For example, Cate utilized a series of *Hanging jackets on chairs* and *Making use of the half wall* patterns in sorting her mail.

Sorting the mail

Cate's mail comes through a mail slot in her front door. She was "sick of a big pile of mail" that "clog[ged] up the floor when you come in." She preferred a quick and easy way to sort mail by importance and by whom the mail was addressed. Mail that was not urgent or was for Paul would



Figure 3 Timmie using the cupboard as a step as an example of making use of the half wall pattern

go on top of a chest that was to the right of the front door. Mail for her tenant, who was in the basement suite, would go by the top of the stairs either on the floor or on the half-height wall a few feet from the front door. Important mail, typically bills or appointment reminders, would be placed on a narrow decorative shelf to the left of the front door (see Figure 4). Lastly, junk and unwanted mail would go in the garbage

This system allowed Cate to "sort her mail right away." The various artifacts and architectural elements were all within a short radius around the door entrance. Cate could quickly organize her mail into piles while standing by the door. Paul knew where his mail could be found but did not know much about the other piles.

Cate later told us that she sorted her mail in a similar way in



Figure 4 From the left corner clockwise: the chest to the right of the door for Paul's and non-urgent mail; a letter on top of the half-height wall for the tenant; mail at the top of the stairs for the tenant; important mail on the decorative shelf to the left

¹ This pattern is reminiscent of the well-known user study that led to a "pile" metaphor for a desktop graphical-user-interface, Mander, R., et al, "A 'pile' metaphor for supporting casual organization of information," *Proc. CHI'92*, ACM Press, (1992), 627-634.

her previous home. There she used a metal basket that hung from the ceiling next to the front door. Important mail went in the basket. While she explains that the basket was “not as cluttered as the shelf,” she felt it looked “crappy” in her current home. Clearly, functionality and use is not the only criterion in designing her system.

The point we wish to emphasize through these examples is the family’s resourcefulness in using artifacts and their physical surroundings. Resourcefulness in everyday design can be expedient and temporary; it can also form the center of ongoing routines, and can be combined to create long-term systems. The activities described are familiar to all of us and therefore may be overlooked. However, on close examination the actions represent specific responses to a particular setting and the results are typically unique. In the next section we describe how systems adapt as situations change and the uniqueness of individuals provide positive catalytic pressures.

Adaptation

We observed systems that are in varying degrees dynamic yet comprehensible and usable to all in the family. In this section, we describe how others impinge upon and change systems, and how evolved use enable systems to adapt.

Going solo

Cate’s ten-year old son, Alec, collects and plays Warhammer, a role-playing game of war figures and models. One session, Cate showed us Alec’s Warhammer items in the family room. They were mostly on the floor. She told us that they used to be on the coffee table. Cate’s mother bought Alec a table and metal tins to organize her grandson’s Warhammer. The tins were meant to store the individual armies, and the table was where he was to play. However, Alec did not use them in this way. The table and some of the tins were in his room. A tin of Warhammer paints was on the kitchen table. Some figures were stored in the tins, but much of it lay around. Cate admits, “Alec seems to have his own system.” It is Cate that tries to maintain the system her mother’s purchases suggest, and not Alec for whom it was intended.

This example illustrates the pattern, *going solo*. The pattern describes an individual approach that works exclusively for one person in a family, regardless of its impact on other members of the family. The impact can be negative, as in the example above. *Going solo* actions critique an existing design or signal a change in a family member that may require some adaptation. The *going solo* actions provide an alternative that may operate in parallel or is targeted at creating change.

Previously, we introduced Timmie who likes to clean and organize the home. We observed a white laundry basket full of clothes sitting on the floor between his bed and the closet in his room. Timmie explained that he uses this basket to bring up his clean laundry. Timmie continues to explain that he does his own laundry because he wants to

do it every week, whereas Janis (so he tells us) “only does laundry every two weeks.” In our own observations, Janis did the laundry several times a weeks. Its not clear if Timmie was in fact being critical of how the laundry is done in the house or is simply exercising his own preferences. Nevertheless, Timmie maintained a parallel approach to doing laundry that augments the existing approach.

Another example from Ryan and Janis’s home is a long narrow shelf that runs underneath the window by the kitchen table. On this shelf are baskets labeled with the children’s names. The baskets are for art supplies. Brenda, who is thirteen-years-old, placed a shirt she had received from her mom for Valentine’s Day in one of the baskets. Brenda ignored that the baskets were for art supplies by storing her shirt there. Aside from whatever message Brenda might be sending her mother about the shirt she received, Brenda explained that she was too old to be sitting at the kitchen table drawing and making art with her brothers.

Design-in-use and cocoon

We can see from the previous examples that Alec, Brenda, and Timmie communicated or provided alternatives through actions of use. In the next example, the *going solo* uses have become incorporated into a system over time.

Janis discusses the family phonebook with us (see Figure 5):

Janis: And someday it [family phonebook] will all go in here [she picks up the new blank phonebook].

Interviewer: Do you want to talk a little more about this book?

Janis: Well, Lori, I was ready to move on but Lori likes the book.

Interviewer: Yeah, why’s that?

Janis: I don’t know. She’s sentimental about the book because it’s



Figure 5 Ryan and Janis’s family phonebook, which has been shaped through use and the incorporation of diverse individual needs

always been here. It's got all the kids...[she puts it down on the table and points to parts on the front page]. It's got emergency numbers...and doctors...and banks...community center, pools, and our work contacts. That's the first page. And *then* it's got everybody alphabetical – its got ferries... and music lessons, so things we needed, I mean for caregivers. And then it's got everybody in alphabetical order...but then it's got the kids by friends...and family. And that was Pat [Janis points at a number on the last page]. I kept that because it has some kid context.

Interviewer: uh-huh

Janis: And that's that. And someday it will go in here [she points to the new book].

As Janis describes, the first page has emergency numbers, family and work contacts. The second page has information for lessons and numbers for ferries. The next few pages have various numbers in alphabetical order as is typical of most phonebooks. Less typical, is that the second to last page has the children's friends' numbers, and the last page has more numbers that Janis or Ryan found important at the time. While Janis wants to transfer the information into a new book, this has not happened yet. In fact, new numbers, such as the ethnographer's continue to be stored in the old book.

As Janis mentioned, she is in part influenced by the fact that Lori wants to keep the book. She later explained that the book began as an emergency contact list for caregivers. This explains the first page. Lori takes care of Janis' children when she is not teaching and so it's not a surprise that she finds it valuable. Interestingly, Brenda is the only one to use the new book. She has listed the numbers of all her friends under "B" for Brenda. This would appear to be an overflow from the children's friends' numbers in the old book, which was full from use.

The phonebook incorporates many individual needs, from caregivers, to the children, to the parents. It appeared to us that each of these influences changed and shaped the structure of the book into its unique form through *design-in-use*. The book has changed over the nine-years of use by adapting to the pressures of use and individual needs. Interestingly, Janis herself is not aware of the value of these changes yet she implicitly sees the value. Despite wanting to replace it, she continues to use it.

In the pattern *cocoon*, we described artifacts that change from the family member's original intended use to another. An example of this is a hanging basket that Lori purchased. Lori explained that the basket was bought at a craft fair. At first it was meant to be a fruit basket for vegetables and fruits; through time, it evolved as a place to put "urgent mail and notices" as part of her overall approach to organizing messages.

In this case, Lori's use of the artifact caused it to change and adapt. We found that *cocoons* typically go through a stage in which they are being used in such a different way than originally intended that a greater change is inevitable. One such example was Lori's planner (see Figure 6):

Lori: My girlfriend gave me a planner and I thought 'oh great – it's one of those Filofax [brand name] things!' It's super-compartmentalized and organized, and I thought, 'this is great – I will have all my little sections, you know, [she flips through the planner] but I really never used the sections properly. And I ended up, you know, just finding my own...way...of storing information [she continues to flip through the book], which half of its...I used to buy the refills and I used to just have papers and write notes and rip them out and it became this sort of like 'oh here's a piece of paper, I'll write down a note, rip it out.' So it's empty now, it used to be full of paper – I just sort of kept the ones – there are some recipes, old phone number lists, and whatever.

Almost from the beginning Lori shifted the use of the planner. As she saw it, she "never used it properly." Nevertheless, she continued to order and use the refill pages. However, the planner had become a notepad of blank paper for use and a place to keep notes whether loosely or bound in the book.

Lori: Then I started to get some sticky notes and so that would end up being stuck in [she motions to slap a sticky note to one of the page]....

The sticky notes allowed her to augment the planner. Notes could now be placed anywhere in the book, even over used pages. And notes could be taken on sticky notes and later stored in the planner if she did not have it with her at the time.

Lori: Like I have, you know, lists of – almost like a calendar but I didn't use the calendar actual...calendar...pages? I would just use them as lists of things that I needed to do for...coming...days. And then I sort of ended up adding, you know, notes to myself. It became just everything. I had like sayings [she shows a saying written on a sticky note stuck on a page] in there that I liked. I'd have teaching ideas that I'd get in other classrooms...dance steps... I don't know – it just had everything!

At this stage Lori's planner had become a place to keep notes and lists. She no longer used any of the originally designed structure of the planner, ignoring the categorized sections for notes and addresses, and the calendar section

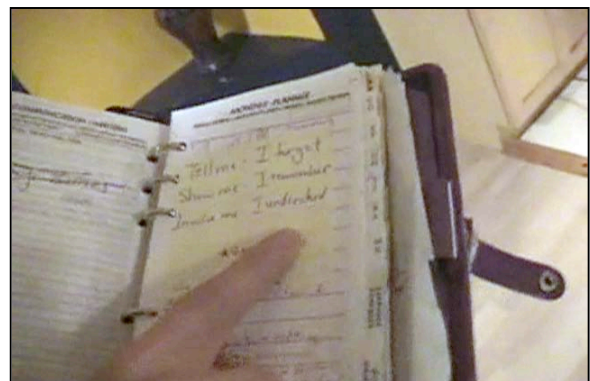


Figure 6 Lori's planner, which she 'never used properly.' Lori is showing how a sticky note is used to record a saying, and how it is stuck over an already used page

(the main design feature). She had even stopped ordering refills since sticky notes allowed her to re-use the already filled or ripped out pages. Lori's agenda book had gone through a metamorphosis through use and as typical with a *cocoon* pattern, substantial change was afoot. Eventually, the change came when Lori stopped using the planner replacing it with a larger system she referred to as her messaging system. The system appropriated a chalkboard, the fridge door, and the hanging basket, we will discuss this in more detail in the next section. This system incorporated phone messages and accounted for the fact that she now needed to share this information with someone else, her live-in partner.

In summary, we have described how systems adapt through *design-in-use* or changes in the family. We identified two patterns related to adaptation through *design-in-use*, a *going solo* pattern in which individual family members would provide an alternative use that either was critical or signaled a change such as Brenda's use of the art supply boxes, or was parallel such as Timmie's laundry basket. We observed that these actions could become successfully incorporated into a system or artifact as in the example of Ryan and Janis' family phonebook. Another, is change through use as identified in the *cocoon* pattern where actions shift the original purpose of an artifact or system into something altogether different. In the next section we observed how families determine the quality of a system.

Quality

We discussed earlier in this paper how appropriated use becomes incorporated into ongoing routines and systems. These routines and systems are relatively stable however always subject to change. We discussed how some of these changes occur and specifically the mechanism or catalytic pressures by which changes occur. Yet, how do families know if these changes are good? How do they judge how well the system suits their needs? In this section we observed explicit action to determine quality and implicit effect related to a successful system. We begin with the implicit understanding that something works.

$1 + 1 = 3$

$1+1=3$ is a pattern that describes how use of a system or artifact works in ways in which family members are not fully aware. In a sense, the whole is greater than the sum of the parts. We encountered an example of this with Ryan and Janis' family phonebook. Janis felt that Lori's attachment to the phonebook was sentimental rather than functional. This is not to say that emotional attachment is not important in artifacts, rather the two are not mutually exclusive. Lori has a history with the phonebook that makes it deeply familiar as a felt experience, however it also supports her role as caregiver. Janis feels that the phonebook should be converted into a more typical structure – the new book is exclusively organized alphabetically, yet she herself continues to use the unique structure of the older book. The fact that Janis herself does

not fully understand how the phonebook works coupled with the fact that it is continually used by most of the members of the family gives it the attribute that the whole is greater than the *awareness* of the sum of the parts.

Another example of this is that Cate leaves a large phonebook on the floor in the family room. Cate is a recreational long distance runner and her ankle had been bothering her. Her physiotherapist used phonebooks for ankle exercises. Cate explained that the phonebook is left on the floor as a reminder for her to stretch her ankle. She also attached a bicycle tire inner tube around the leg of her couch. She used the inner tube for another exercise. In addition to repurposing artifacts, the actual artifact serves as a reminder. An obvious consequence of having the artifacts visible is that she can readily find them. In Cate's instance, finding needed items is an ongoing issue in the home and so this routine is particularly effective.

Interestingly, this pattern was most obvious in reverse. Late in our study, Lori's landlord purchased a new fridge. The new appliance had a dramatic impact on her messaging system. The new refrigerator was stainless steel and therefore was not magnetic. The old refrigerator door served a role in her messaging system as a display and storage of school information for her son. These items were now displaced and by the end of our study had made their way onto the inside of cupboard doors, the side of the refrigerator and in some cases had not yet been resolved. Lori commented on her ongoing frustration with this issue.

Testing a Chalkboard

Testing out systems in use was a common theme we encountered early in our study. In a preliminary study of two additional families, we found one family was trying out a chalkboard in the kitchen for messages. In this case the mother and the daughter thought it best to simply put it up and see if other family members would start to use it. We named this pattern, *testing a chalkboard*. The significance of this pattern is the testing out of a new system by use.

Janis and Timmie similarly tested out a whiteboard calendar placed on the refrigerator door. They were hoping this would help coordinate everyone's busy and varied schedules. For example, Ryan had a separate calendar exclusively for his use that was on a hallway corkboard. He too is an avid runner and so he used the calendar to schedule his runs and other activities like karate. The children had very busy schedules of dance, soccer, karate, and music lessons. Janis hoped everyone would migrate to fridge door calendar and so she and Timmie simply began using it. By the end of the study, all except one of the children were using the fridge calendar.

This pattern typically involves one or more protagonists who take the initiative to put a system in place. In this case, the concept of testing is as much the protagonist shifting the routines of others to adapt to a new system. What is in

effect being judged is the balance between adoption of the system and adaptation of family members' routines.

As we discussed in the previous section, Lori evolved her planner into a system that involved a chalkboard, the fruit basket, the fridge door, and sticky notes. She naturally found the system quite effective, however, for Abe, her partner, it was less clear.

When Lori was asked if she was the only one who used the chalkboard, she replied "Sort of." She has tried getting Abe to use it, or to get him used to the idea that all his messages would be written there. However, he seemed to resist the idea yet Lori felt he would have to get used to it since she would continue to write all his phone messages on the chalkboard. A compromise that Lori would settle for is that Abe would not have to write messages on the chalkboard but would have to understand that this is where his messages would be found. A more sophisticated part of Lori's messaging system was the use of the fruit basket in conjunction with the chalkboard. Messages and lists would be placed in the lower basket. Once, when Abe was looking for a note that was on the chalkboard, Lori told him she wrote it down and it was now in the basket. This came as no surprise to Abe revealing his awareness of her system. Further, during one session, Lori returned home and pulled a folded note from the basket (see figure 7). She unfolded it and said that it was a grocery list and that Abe didn't have time to get all the items. She later explained that she and Abe would leave shopping and to-do lists for each other in the basket. Since these lists were visible in the wired basket Abe or Lori would pick up the list on the way out. If they were unable to complete the list it would be returned to the basket with the purchased items crossed off. It is evident that despite Abe's resistance in some areas of using Lori's messaging system other aspects worked quite well.

In summary, we have described an implicit, even unconscious sense that a system is working. This is characterized by our $1+1=3$ pattern in which the full complexity of the system is not consciously understood,



Figure 7 The hanging basket is used to place lists that are visible to both Lori and Abe

however tacit understanding is clear through continued use and appreciation. More explicitly, protagonists of systems are consciously testing the use of a new system or change. The intent is often to find equilibrium between adopting a system and shifting the routines of family members.

DISCUSSION

Our findings describe how everyday designers *appropriate* artifacts and surroundings and the role of design-in-use in the dynamic routines and systems in the home. Several examples such as the use of lawn chairs as tables (see figure 2) or the kitchen cupboards as steps (see figure 3) illustrate how simple actions discover and exploit affordances of artifacts and surroundings and put them to new use. These acts become incorporated and form the basis of ongoing routines and systems. This is best illustrated by Cate's mail sorting system (see figure 4) and Lori's messaging system (see figure 7).

These findings echo Crabtree's notion of *ecological habitats* in the home, in which mail, for example, is ecologically distributed throughout the home such that affordances of sight situate where mail is stored, used and displayed [7]. However, our findings additionally show how such systems are established and explicate how the protagonists are creatively aware of their making. For example, Cate explained how her current system is a modified version with aesthetic improvements of an earlier mail sorting system from a previous home. Lori is aware of how parts of her messaging system work and others need improvement or are acceptably compromised; such as the way Abe interacts with his messages. She and others consciously *test* out systems in use in order to see how family members balance adoption with modification of their routines.

These and other findings provide a view of the different roles family members play in shaping design in the home. We differ from Taylor's notion of a centralized and hierarchical approach to organizing systems in the home [16]. In fact, we found that individual actions of use of all family members contribute, and can be said to provide innovative pressures on the design of everyday systems. We provide a more nuanced view on who is involved in the making and evolving of systems. We too observed in our study, a central role of mothers in shaping systems, yet as we identified, others strongly influence routines and systems, whether they be the parallel approaches of Timmie or Alec, or other *going solo* patterns of use that become integrated over time.

Such design-in-use is at the heart of everyday designers' creative approach, from judging quality to seeding actions for new uses of artifacts. The simplest of appropriations are often opportunistic and temporary; however, it is through experiencing appropriations in use that further ideas, combinations, and recombinations are generated, forming new routines and systems. Taylor refers to this as the *pliability*, alterable over time, and the *artful* or unique

nature of systems in the home [16], what we refer to as adaptation. We expand on these notions by explaining at a granular level how artifacts are altered over time to become more unique, and specifically address a need, such as Ryan and Janis' family phonebook (see figure 5) or Lori's planner (see figure 6). In each case the artifacts were shaped and reshaped through use. Key to these examples is the pliability of each of the artifacts. The family phonebook was essentially a homemade affair, comprised of a paper binder of blank pages with alphabetic headings created by a word processor and computer printer (see figure 8). As such, it was easily modified. Our example of Lori's planner focused on the materials and how easy it was for her to substitute new uses or even substitute materials by integrating sticky notes. In the *cocoon* pattern we found that artifacts, systems, and routines change dramatically from their original use to a new use that an even greater change is inevitable. During this stage, the use may be so unclear or contradictory, yet this does not preclude it being continually used until it changes. For example, to return to Lori's fruit basket, at one stage it was a place to store her sunglasses, avocados, and urgent mail (see figure 8). Yet, continued use of the basket allowed for its use to evolve into becoming part of her message system. Given that we view everyday design as a creative process it is no surprise that allowance is made for emergent properties to manifest over time.

We also showed how emergent properties played a significant role in forming sensibility and judgment about the quality of a system, as in the *I+I=3* pattern. Ryan and Janis's family phonebook had many design qualities that were not readily evident yet were tacitly understood through its continued use.

What becomes apparent is that the ongoing dynamics and pressures on everyday design actions shape routines and systems into a level of uniqueness that is finely tuned to the



Figure 8 Two examples of design-in-use: on the left is the home-made family phonebook made to be pliable, and on the right is Lori's hanging basket as a *cocoon* pattern

combined needs of family members in their setting. Equilibrium is sought in which routines and adoption are balanced against each other supported by the resourceful appropriation of artifacts and surroundings. The everyday unique routines and systems are a result of creative actions as defined by resourcefulness, adaptation, and judgments of quality. In summary, we see artifacts and surroundings as *creative resources* that are continually appropriated to tune and shape a system to the setting and needs across the family.

IMPLICATIONS

In many respects, theoretical foundations for the notion of everyday designers are not new. After all, people have been redesigning our designs all along. Suchman has argued for restating production and use such that a distinct boundary does not lie between them [15]. Alexander [1] discussed what he called the *unselfconscious process*. He describes a design system that maintains equilibrium through constant actions over time. Actions taken by any individual who could simply recognize a failure and could react in a corrective way. Alexander would eventually describe the process of continuous adaptation as *piecemeal building* [2]. Louridas' concept of designer as *bricoleur* describes a continuum of activity that presages the everyday designer [8]. Designers like *bricoleurs*, make do with resources available to them and explore the situation through action for new uses and connections.

As designers, we consider our findings through the lens of design. The implications we discuss here are part of our ongoing analysis. We would on a final note, like to consider these preliminary design implications.

Design of creative resources – This notion is an overarching concept for a design approach that can integrate and leverage the everyday design actions described in this paper. While the idea of designing *creativity tools* to support creativity is taking root, we'd argue for the notion of designing technology artifacts that can become *creative resources* that can become everyday artifacts to be resourcefully appropriated.

Unique systems and routines – The creative design process in everyday design is strongly oriented toward evolving unique outcomes. The appropriation and catalytic pressures of use, shape and reshape systems and routines to become highly tuned to the needs of the family and the setting. This is a challenge to technology design since it is oriented toward generic or at best segmented use.

Unremarkable affordances – We borrow the term 'unremarkable' from Tolmie et al [17], who argue for unremarkable computing for everyday routines. For example, the use of the lawn chairs as tables is an action that exploits the affordances of the chairs while remaining unremarkable. Interaction design should aim to augment actions through simple artifacts and devices that afford appropriations. Such simple appropriations are at the heart

of everyday design, and yet should be visible in the context of the everyday, readily available for opportunistic and unremarkable uses.

Adaptation – Dependant on the idea of *unremarkable affordances*, design artifacts that are approachable and open to new uses lead to the catalytic pressures of individual actions that are critiques, alternatives, or parallel augmentations (as described in our *going solo* pattern). In addition, such artifacts allow for a creative use that allows for emergent properties to manifest as an artifact transitions from its originally intended use to a new use (as described in our *cocoon* pattern).

CONCLUSION

We found that creativity is at the heart of everyday design. Family members are resourceful in how they appropriate artifacts for new uses in routines and systems. Such systems continually evolve through the catalytic pressures of individual actions and continued use. The family members as everyday designers explicitly test-in-use systems to judge for quality and hold implicit understandings of the emergent properties of systems that makes them successful.

In this paper, we reported on our study of three families in which we were researching the concept of everyday design in the home. We discussed background concepts of design ethnography and pattern languages. We provided in-depth descriptions and discussions of our observations and patterns.

The research contributes descriptions of the appropriation of artifacts and surroundings as design resources and fundamental actions in everyday design. We describe the central role of design-in-use in responding to the dynamic and contingent nature of routines and systems. We explain the roles of *resourcefulness*, *adaptation*, and judgments of *quality* as aspects of creativity in everyday design. Lastly, we outline design implications in which the need to design *creative resources* is an overarching notion.

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