UNIVERSITY OF CALIFORNIA,
IRVINE

An Ethnographic Examination of the Relationship of Gender & End-User Programming

DISSERTATION

submitted in partial satisfaction of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

in Information and Computer Sciences

by

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2008

The dissertation of Jennifer Ann Rode
is approved and is acceptable in quality and form for
publication on microfilm and in digital formats:

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2008

To Unlikely Inspiration

"We may know that the work we continue to put off doing will be bad. Worse, however, is the work we never do. A work that's finish is at least finished. It may be poor, but it exists, like the miserable plant in the lone flowerpot of my neighbour who's crippled. That plant is her happiness, and sometimes it's even mine. What I write, bad as it is, may provide some hurt or sad soul a few moments of distraction from something worse. That's enough for me, or it isn't enough, but it serves some purpose, and so it is with all of life."

…

"I weep over my imperfect pages, but if future generations read them, they will be more touched by my weeping than by any perfection I might have achieved, since perfection would have kept me from weeping and, therefore, from writing. Perfection never materializes"

…

"Since I have nothing to do and nothing to think about doing, I'm going to describe my ideal on this sheet of paper—"

Fernando Pessoa
The Book of Disquiet

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- Blackwell, A.F., D. Edge, L. Dubuc J., J. Rode, M. Stringer, and E. Toye. (2005). "Using Solid Diagrams for Tangible Interface Prototyping." IEEE Pervasive **4**:4, p74-77.
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- Rode, J.A., E.F. Toye, and A.F. Blackwell. (2004). "The Fuzzy Felt Ethnography - Understanding the Programming Patterns of Domestic Appliances." Personal and Ubiquitous Computing **8**: 3-4, p161-176.

Refereed Papers:

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- Wolf, T. V., J. A. Rode, W. Kellogg & J. Sussman (2005). "Dispelling Design as the Dark Art of CHI." Proceedings of ACM Conference on Human Factors in Computing Systems, CHI 2006 (Quebec, Canada). p. 521-530. (Best of CHI Nominee).
- Rode, J.A. (2005). "Appliances for Whom? Considering Place." Proceedings of the 3rd International Conference on Appliance Design. (Bristol, UK).
- dePaula, R., X. Ding, P. Dourish, K. Nies, B. Pillet, D. Redmiles, J. Ren, J. Rode and R. Silva Filho (2005). "Two Experiences Designing for Effective Security." Proc. Symp. on Usable Privacy and Security SOUPS 2005 (Pittsburgh, PA), p 25 - 34
- Rode, J.A., E.F. Toye, and A.F. Blackwell. (2005). "The Domestic Economy: a Broader Unit of Analysis for End User Programming." Proceedings of ACM Conference on Human Factors in Computing Systems, CHI'2005 (Portland, OR), p 1757 – 1760.
- Rode, J.A., E.F. Toye, and A.F. Blackwell. (2004). "The Fuzzy Felt Ethnography - understanding the programming patterns of domestic appliances." Proceedings of the 2nd International Conference on Appliance Design (Bristol, UK)., p. 10-22.
- Stringer, M., E.F. Toye, J. A. Rode, and A.F. Blackwell (2004). "Teaching Rhetorical Skills with a Tangible User Interface." Proceedings of Interaction Design and Children IDC'04 (Maryland, MD), p11-18.
- Blackwell, A.F., M. Stringer, E.F. Toye, and J.A. Rode. (2004). "Tangible Interface for Collaborative Information Retrieval." Proceedings of ACM Conference on Human Factors in Computing Systems, CHI'2004 (Vienna, Austria), p 1473-1476.
- Rode, J., M. Stringer, E. Toye, A. Simpson, and A. Blackwell. (2003) "Curriculum-Focused Design." Interaction Design and Children 2003 (Preston, UK), p 119-26.
  Stringer, M., J. A. Rode, E. F. Toye, and A. F. Blackwell. (2003). "Iterative Design of Tangible User Interfaces." BCS HCI 2003 (Bath, UK), p 89-92.

Patrick, E., D. Cosgrove, A. Slavkovic, J. Rode, T. Verratti, and G. Chiselko. (2000)."Using a large projection screen as an alternative to Head-Mounted Displays for Virtual Environments." CHI 2000 (Hague, Netherlands), p 478-485.

Publications & Other Research (cont.):

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Workshop Papers & Posters:

- Rode, J. A. (2006) "Unlocking the Door to the Domestic." Ubicomp 2006, in Newport Beach, CA. (Doctoral Consortium).
- Rode, J.A. and J. Kaye (2006). "Is to Nurture in Technology's Nature?" Ubicomp 2006 in Newport Beach, CA. (Workshop Position Paper).
- Rode, J.A. and L. Barkhuus (2006). "Position for Networking in the Home Workshop." CHI 2006 in Quebec, CA. (Workshop Position Paper).
- Rode, J.A. and J. Harris (2005). "What Makes a Closet "Smart"?" Ubicomp 2005 in Tokyo, Japan. (Poster).
- Rode, J.A. (2005). "Situating Ubicomp amongst Household Flows." Ubicomp 2005 in Tokyo, Japan. (Workshop Position Paper).
- A. F. Blackwell, J. A. Rode and E. F. Toye (2005). "The Social Context of Domestic End-User Programming." Less is More – Simple Computing in an Age of Complexity Forum at Microsoft Research Cambridge in Cambridge, UK. (Workshop Abstract and Talk).
- K. P. Fishkin, S. Consolvo, J. Rode, B. Ross, I. Smith, and K. Souter. (2004)."Ubiquitous Computing Support for Skills Assessment in Medical School". UbiHealth 2004 Workshop at Ubicomp 2004 in Nottingham, UK. (Workshop Position Paper).
- Rode, J. (2003). "The Myth of the Usability Toolbox." Interact 2003. (Workshop Position Paper).
- Ogline, J., Kelly, J. Rode, J., Kotovsky, K (1998). "Experiencing Time" 1998 American Psychological Society Conference. (Poster).

S. Consolvo, J.A. Rode, D. McDonald, C. Riley, "Developing Privacy Personas: Handling Inconsistencies in Attitudes & Behaviors," Intel Research Seattle. IRS-TR-05-019, (Dec 2005).

ABSTRACT OF THE DISSERTATION

An Ethnographic Examination of the Relationship
of Gender & End-User Programming
By

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Doctor of Philosophy in Information and Computer Sciences

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My dissertation ethnographically investigates gendered patterns of use in domestic programming. I study the home as it is a critical environment in which we socialize children in socially approved attitudes towards gender and technology. I argue there is a masculine bias in usability and design processes. I examine the problematic relationship between femininity and technical mastery, in that it is a source of Gender Inauthencity for women who wish to participate in technology. My work seeks to understand this tension. I outline gendered usage patterns in everyday use of domestic technology. I draw from anthropology, gender studies, STS, design research, ubiquitous computing, and social informatics.

In conducting this work I reframe the discussion of the role of gender in technology from something that merely needs to be controlled for, to something with inherent power imbalances that is socially constructed, which organizes everyday life. I argue technology is an object around which individuals negotiate their Gender and Technical Identities.

1 Gender and End-User Programming

1.1 Motivation

Everyday life is shaped by relationships among adults and children, and homes are a key location where these dramas play out. The home is also a principal site of technology use. Often these relationships are gendered in nature, making homes highly gendered spaces. Technology plays an important role in these dramas. Gender plays an important role not just in our interpersonal relationships, but also in how we interact with our environment. The objects and technologies in our homes themselves have gender attributes, and we respond to social norms regarding gender in our interactions with them. We have additional gender norms surrounding programming in the work place, which in turn affect programming of these gendered technologies in the home. As we increasingly introduce programmable technologies into the home, gendered attitudes become enmeshed in how we discuss and use these technologies.

While many researchers are creating new technologies for the home, the creative process occurs largely independent of any discussion of gender or discussion of the historical and sociological trends that govern the structure of activity in the home. To better understand how gender and programming practice interact, I

conducted an ethnographic study of the domestic context in which end-user programming occurs, with a particular focus on gender and end-user programming. In this dissertation, I will demonstrate that information technology is an object around which individuals negotiate their Gender and Technical Identities. Further, I will show what this negotiation process means for the usage patterns surrounding technology, and also how it fits into the larger program of feminist studies.

Technology in the home is changing how domestic work is accomplished. Women are increasingly involved in the labor market (Bureau of Labor Statistics, 2004), while at the same time, married women often serve as their families' primary caregivers. Technologies introduced into the home have changed the type of domestic work done by removing much of the physical labor. Today, for example, vacuum cleaners, indoor plumbing, and central heating have replaced the need to beat rugs, fetch water, and gather firewood. In short, the nature of household work has changed from the production of to the consumption of goods (e.g., baking bread "from scratch" including raising and milling grain has been replaced simply by buying a loaf) (Cowan, 1983; Strasser, 2000). At the same time, we have seen a remarkable stability in the amount of time domestic work by women requires (Cowan, 1983). In particular, increased standards of

cleanliness; time-consuming issues related to "good parenting"; and new activities such as the need to comparison shop now fill the time vacuum for many housewives (Cowan, 1983; Strasser, 2000). The gendered nature of domestic work, and the fact that many of these new technologies require programming raises important issues for the design of new technologies. HCI researchers need to be cognizant of these trends, and need to design technology that attacks them head on by creating technologies that actually reduce domestic work. In order to do this, we need to understand the allocation of domestic programming tasks and the difference in men's and women's attitudes towards technology.

The body of work on end-user programming leaves room for further study with regard to gender and the home. Existing work on end-user programming establishes tinkering and self-efficacy (which I shall explain in greater depth later) as concepts key to understanding the gendered nature of programming, and yet they have not been considered in a domestic context.

Despite this, the existing work designing end-user programming interfaces for the home lies primarily within systems development. There has been little work that attempts to look at how existing programmable devices are used in the home. The systems that have been developed do not explicitly take into account gender roles or

power dynamics inherent in the home, nor do they discuss programming as an activity of the domestic ecology, rather than of the isolated domestic user.

There are at least four important knowledge gaps in current research studies that attempt to address the relationship between domestic programming and gender.

- Gap 1: There is a need for understanding the difference in men's and women's attitudes towards technology and the allocation of domestic programming tasks.
- Gap 2: There is a need for understanding the gendered nature of domestic appliances and how this relates to programming.
- Gap 3: There is a need for studying end-user programming concepts such as tinkering and self-efficacy in the context of a household, thus permitting a better understanding of the role of gender and the multi-user context.
- Gap 4: There is a need for research designing guidelines that allow for the design of home-computing technologies that take into account gender roles, power dynamics, and programming as an activity of the domestic ecology.

Given the research on gender studies and end-user programming, there is an established need for studies to contextualize the activity of

domestic end-user programming that informs the design of these home-control systems.

1.2 Research Approach and Research Questions

To address these gaps, I investigated gendered patterns of use in domestic programming. My work to date shows that men and women are equally capable of performing domestic programming tasks. They are also programming appliances in equal numbers and reporting the tasks to be of equal difficulty[1]. Despite this, my collaborators and I see programming specializations along gender lines that reflect the social division of work in the household. At the same time, programming is not simply about gender differences in cognitive processes, both tinkering and self-efficacy are core to understanding programming. Tinkering and self-efficacy have only been studied in labs and have not been studied in the context of gendered appliances; additional *in-situ* work is required to understand the practice of domestic programming. As part of my work, I will answer the following important questions related to the gaps described in section 1.1.

[1] In my prior work I did not consider self-efficacy, so examination of its role in these assessments of difficulty remains to be done.

- First, are there differences in how individuals go about programming "masculine" and "feminine" appliances, and how are these tasks treated in terms of technological complexity?
- Second, given the gendered nature of appliance programming, how does gendering affect interactions with technology, especially with cross-gendered appliances in terms of self-efficacy and the ability to program?
- Third, does the level of technological complexity in a household affect who programs what, and does it influence household members' attitudes towards programming these devices?
- Fourth, how do the social dynamics of the household interact with women's ability to program and to tinker?

The next section provides a brief description of the remaining seven chapters of the dissertation.

1.3 Dissertation Outline

The dissertation is organized in the following manner.

- **Chapter 2- Prior Work:** This chapter discusses my previous work which established that men and women are equally capable of performing domestic programming tasks. They are also programming appliances in equal numbers and find the tasks to

be of equal difficulty. Finally, I discuss a specialization of programming tasks along gender lines that reflect the social division of work in the household.

- **Chapter 3- Previous Work- Gender and End-User Programming:** This chapter provides a survey of the history and sociology literature regarding gender roles and division of domestic labor in American homes. It also looks at the gender-studies literature discussion of the differences in how men and women approach technology and how technology is itself gendered. Finally, it looks at the end-user programming and ubicomp literature focusing on smart homes. In reviewing these bodies of literature, I have observed an absence of work that addresses domestic end-user programming. In response, I build a case for the need of additional work at their intersection.
- **Chapter 4- Study Design and Methods:** This chapter discusses the rationale for the research-site selection. It also describes the qualitative data-collection methods.
- **Chapter 5- Technology Usage Patterns within Households:** This chapter describes my field research that looked at technology used to achieve safety and security in 20 California homes.

- **Chapter 6- Constructing Gender & Technological Identity in the Home:** This chapter looks at the data in Chapter 5 and interprets it in light of theory surrounding gender and technical identity. I discuss how gender and technical identity are co-constructed in the home.
- **Chapter 7- Creating Technologies that Afford Co-Construction of Gender and Technical Identity:** This chapter draws together the analysis presented in chapters 5 & 6 and discusses the relationships among gender, programming, and technology design. The chapter also presents design recommendations based on the research findings.
- **Chapter 8- Conclusions and Future Work:** This chapter presents the major contributions of the study, an overview of future work, and concluding remarks about the dissertation.

2 Prior Work

2.1 Introduction

The foundation of my research was a series of studies looking at gender and end-user programming in the home conducted with my colleagues at the University of Cambridge[1]. The first was an ethnographic study of appliance use in the home which aimed to broadly understand the range of devices being programmed in the home and to investigate potential gendered patterns of use. The second was a diary study of families that provided an in-depth look at family dynamics surrounding VCR use. My research to date shows that men and women are equally capable of performing domestic programming tasks; they are programming appliances in equal numbers; and they find the tasks to be of equal difficulty. The remainder of this chapter will describe each of these studies in greater depth.

[1] These studies were conducted at the University of Cambridge's Computer Laboratory with Eleanor Toye, Alan Blackwell, and Mark Stringer.

2.2 The Fuzzy Felt Ethnography[2]

The Fuzzy Felt Ethnography looked at nine households and which domestic appliances users choose to "program". These appliances were broken into two conceptual categories for analysis: those that allow users to program actions for the future and those that allow for macro creation to make repeated tasks easier.

2.2.1 Method

2.2.1.1 Participants

Nine professional households representing a variety of household structures were interviewed, including; three single-person households (two women and one man), three households of younger, childless couples, one family with children, and two 'empty-nester' couples whose grown children had left home. The age range of the participants (not including the children) was 29 to 60 years, with a mean age of 40.6 years. The participant households were recruited via colleagues and acquaintances, and all lived in or around Cambridge (UK). A middle-aged, relatively prosperous, settled and well-educated sample was chosen because it is a significant target market for high-end

[2] Section 2.2 is based on: Rode, J.A., Toye, E.F. and Blackwell, A.F. (2004). "The Fuzzy Felt Ethnography - understanding the programming patterns of domestic appliances". Personal and Ubiquitous Computing 8, 161-176.

programmable domestic technologies, and the participants were likely to have reasonable numbers of programmable devices in their homes.

Potential participants were screened by telephone interview to gather demographic data on the household construction. All participants were non-programmers and non-computer scientists. Household membership was limited to a maximum of two adults because it was not feasible for the research team to conduct more than two individual interviews in a single evening session. This research aimed to gather broad descriptive data rather than statistically significant data. Dinner was used as an incentive to participate. Participants were recruited by requesting assistance from colleagues and acquaintances.

2.2.1.2 Provocative Data Collection

My colleagues' and my approach to data collection was inspired by a quote of Gaver, Dunne, and Pacenti in their article *Cultural Probes,* in which they made a strong case for information-gathering methods that are provocative:

> Using official looking questionnaires or formal meetings seemed likely to cast us in the role of doctors, diagnosing user problems and prescribing technological cures....Trying to establish roles as provocateurs, we shaped the probes as interventions that would affect the elders while eliciting informative responses from them (Gaver, Dunne, and Pacenti, 1999, p. 25).

My colleagues' and my intent was to establish this sort of rich dialog with participants, and we considered Mateas, Salvador, Scholtz, and Sorensen's felt board as a source of inspiration (Mateas, Salvador, T., Scholtz, J., & Sorensen, 1996). Mateas et al. used their felt board to model daily home life. He and his colleagues asked participants to walk through a typical day using a felt board and felt shapes to represent the rooms, people, artifacts, and activities in the home. Mateas et al. assert that 'the visual and tactile engagement of the board facilitates the recall and keeps the conversation grounded.' (Mateas et al., 1996).

2.2.1.3 The felt board

The felt board was used as the primary data gathering tool for understanding the *programming* of domestic technology.

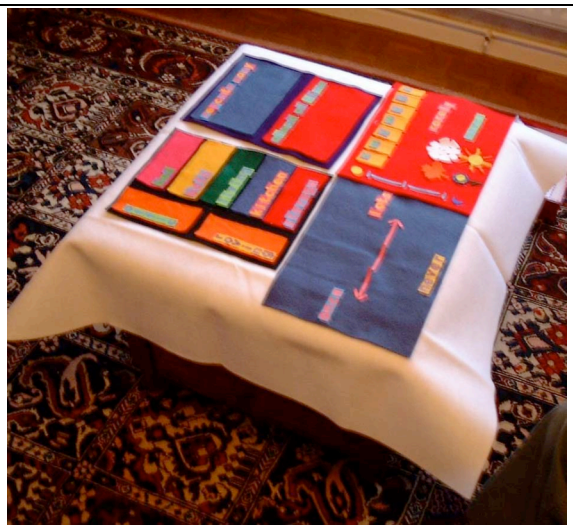

Figure 2-1: Felt board

Icons were designed to represent appliances commonly found in British homes. A subset of the icons is shown in Figure 2-2a (See page

40). In order to ensure that the icons were easily recognizable, a mini-usability study was performed. It used Nielsen's method for designing on-screen icons (Nielsen & Curtis, 1995). Five participants were given individual icons drawn at random to identify in a freeform fashion. Participants were asked to match icons with labels, which permitted a process-of-elimination approach. The icon design was iterated upon until an approximately 75% freeform recognition rate was achieved, with the matching rate being nearly 100%. The research team was content with this number, as it was very difficult to design, for example, a universally recognizable fuzzy felt 'security system'. During the main ethnographic study, all icons were introduced to the participant and referred to by name and pointing gestures. If participants had any questions, they were reminded of what the icon depicted.

The board itself consisted of four sections (Figure 2-2 b-d, see page 40). The first listed seven categories of rooms: bed, bath, living, kitchen, storage, roving, and office (Figure 2-2b). These were categorical constructs that did not necessarily correspond to physical rooms. Thus 'bed' would correspond to all bedroom appliances; 'office' might not be a physical room at all but a corner of the living room reserved for work; 'living' could refer to places that contained the primary television viewing area, which may have been dining areas or

formal and informal entertaining spaces. Roving referred to appliances such as mobiles, PDAs, and cameras that could be moved around the house. Felt icons representing appliances could be placed into these categories on the felt board.

Once appliance icons had been identified and placed on the room category board, they could then be sorted into the two programming categories (labeled 'repeats easy' and 'ahead of time' on the board) by the participant (Figure 2-2c). [3] Participants were first asked to move icons for appliances which could be used to make repeated tasks easier onto the 'repeats easy' section of the board. Participants were asked whether they had in fact used the 'repeats easy' features of these appliances. If they hadn't, they placed the corresponding icon on 'never'; otherwise they were asked to describe in what way the device made their life easier, and how often they engaged in this programming task and to place the corresponding icon on a scale ranging from 'once' to 'lots' (Figure 2-2d).

They were then asked to choose the icons for appliances which permitted programming of actions 'ahead of time' (Figure 2-2e).[4]

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[3] At no point was the word 'programming' used in the experimenter's script

[4] Some appliances were identified by participants as having both 'repeats easy' and 'ahead of time' functions. When a participant wanted to discuss an appliance with 'ahead of time' functions which had already been placed on the 'repeats easy' section, they simply moved the icon from one section of the board to the other, after the board had been photographed with their

Participants were asked about the frequency with which they conducted these programming tasks, e.g. daily, weekly on fixed days, weekly at random intervals, seasonally, rarely, or never programmed. Participants were asked to classify their habits by placing the appliance icon on the corresponding section of the board and discussing how and when they typically used the appliance.

2.2.1.4 Procedure

This study took place in the evening so all household members could be at home. There was one experimenter for each adult member of the household. The research team brought dinner and used it as an opportunity to build rapport and to get background information. This approach has been used successfully by the HomeNet project (Kraut, Scherlis, Mukhopadhyay, Manning, & Kiesler, 1996) and by Mateas et al. (1996). Following dinner, the research team asked for a tour of the appliances in the home. Experimenters then paired up with the adult householders and had a session with the ethnography board. This was followed by a post-test questionnaire regarding a selection of common appliances. Questions involved:

- How frequently the appliance was used;
- How easy or difficult it was to learn;

---

selected 'repeats easy' icons.

- An estimate of over what duration and for how long learning occurred;
- What people, services, or documentation were used to facilitate learning.

Participants were then debriefed and allowed to ask questions of the experimenter.

2.2.2 Results

2.2.2.1 Overall

The nine households possessed more than 250 separate appliances, ranging from programmable cat-feeders to bread-makers. Some appliances, alarm clocks and VCRs, for example, were truly ubiquitous and were programmed by the majority of users: 14/15 users programmed alarm clocks, and 11/12 users who owned a VCR programmed it. Despite their ubiquity, central-heating timers were not always programmed. This ethnographic approach allowed an understanding of why these sorts of differences occurred: alarms and VCRs must be set if an action is to be performed while the user is asleep or away, but with heaters it is often easier for users to say they want heat now than to predict their heating needs.[5] Numbers of

[5] The data is described in terms of households, appliance types, and individual participants. Because of the fairly small number of individuals and households involved in the study, this research describes the findings, rather

appliances per household ranged from 22 in a single male's home to 55 in the home of a couple who had just moved in together. The mean number of actual appliances per household was 34.2, and the mean number of appliance types (e.g. 'toaster', 'kettle', 'VCR') per household was 29.4 (see Figure 2-3). [6]

2.2.2.2 'Ahead-of-time' v/s 'repeats-easy' appliances

Overall there were more 'ahead-of-time' appliances observed, both in terms of number of appliances programmed (100 'ahead-of-time' appliances compared to 64 'repeats-easy' appliances) and number of appliance types (20 types of 'ahead-of-time' appliances

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than treating the sample as representative of any larger population. Thus this research does not assume that, for instance, the behavior of men and women in the sample can necessarily be generalized to apply to any particular larger population of households. Therefore no statistical tests were performed. In presenting this research means and ranges are shown when and where they are an effective way of summarizing the data, but in doing so we do not assume that the data is normally distributed.

[6] Although all the electrical and electronic appliances mentioned by the participants were recorded, some appliances from the count of number of appliances per household were excluded. Appliances which might be considered part of the fixtures and fittings of the house were not always mentioned and so were not always recorded consistently. For this reason, the count excluded power showers, extractor fans, and heating systems. Power tools, garden tools, car appliances were excluded because not all participants were comfortable showing the garage, and not being in the same room introduced variability in recalling appliances. However, when participants revealed useful information about programming these appliances, the information was included in the discussion data below. Fridge/freezers, washer/dryers, TVs with integrated VCRs, PCs with peripherals including printers, and multi-part stereos were each counted as one item. Appliances that were unique to only one household were included, but we also reported these idiosyncratic appliances separately.

compared to 13 types of 'repeats easy' appliances). Table 1 and Table 2 (See page 47) show the range and mean number of appliances and appliance types by household, for appliances that were believed to be programmable and then for those that were actually programmed.

For each appliance that was actually programmed the research team asked a question about how easy or difficult it was to use for a specific task, for instance scheduling a recording on a VCR (Figure 2-4 on page 41). Participants marked a point on a 10cm line representing difficulty, with the leftmost point zero being 'difficult', and the right end 10cm being 'easy'. The perceived ease ratings of the specified tasks were roughly the same across the 'ahead-of- time' questions (mean rating 7.6/10 where 10 = easy and 0 = difficult) and 'repeated tasks' questions (mean rating 7.4/10).

Figure 2-5 shows the numbers of appliances believed to be programmable by household, and then breaks them down by programming category ('ahead of time' or 'repeats easy'). Note that Figure 2-5 through to Figure 2-7 do not necessarily represent the appliances that were actually programmed, only those that were believed to have programmable features.

Figure 2-6 and Figure 2-7 show the number of appliances believed to have the capacity for programming, either for 'setting up ahead of time' tasks or 'make repeated tasks easier' tasks.[7]

2.2.2.3 'Repeats easy' appliances

For all the 'repeats easy' appliances present in at least three households, the research team looked at how frequently they were programmed (Figure 2-8), and how many of them were present in the sample (Figure 2-9).

2.2.2.4 'Ahead-of-time' appliances

For all the 'ahead-of-time' appliances present in at least three households, the research team looked at the intervals at which they were programmed (Figure 2-10) and how many of them were present in the sample (Figure 2-11).

2.2.2.5 Demographics

For each appliance that was named as programmable, the research team looked at how many of the 15 participants (men = 7,

[7] Although hot-water heaters or heating controls were not included in the count of numbers of appliances per household because of their anomalous status as fixtures and fittings, this research still examined their programmable features. Car appliances were excluded from the appliance count because of variability in how they were recorded. However, if participants discussed programmable features, for instance of car radios, we analyzed their responses. These items were included in some of the graphs and discussion.

women = 8) reported actually programming this type of appliance (Figure 2-12). For ‘ahead-of-time’ appliances, slightly more women reported programming activities, while for ‘repeats-easy’ appliances, slightly more men reported programming.

Figure 2-4 looks at the ease of use of appliances. Note that all the appliances that women rated as easier than men are 'ahead-of-time' except for the security system, while all the appliances that men rated easier than women are 'repeats-easy' except for the video recorder. This is congruent with the data in Figure 2-12 which showed that on the whole, women actually had slightly more practice with ‘ahead-of-time’ appliances and men had more practice with ‘repeats easy’. Another way of looking at this difference between men’s and women’s preferred appliances is in terms of domestic control versus entertainment: the appliances that women thought were easier to program all permit domestic control, whereas men were more comfortable with mobiles, PCs, etc. The only exception to this classificatory rule was that men regarded washing machines (definitely a domestic control device) as easier to set up than women did.

For households #2 through #7, the research team compared the numbers of appliances that were listed as potentially programmable by the man and the woman in each household. As Table 3 shows, for households #2 to #5, there were only minor differences between the

numbers of programmable appliances reported by male and female partners. In households #6 and #7, the men both reported a much larger number of programmable appliances than the women.[8]

Household members typically did not actually program all their appliances in all the ways that they believed were possible. Looking at the difference between the total number of potentially and actually programmed appliances by gender, women reported a total of 21 appliances and men reported 27. However, the gender difference appears to be attributable to the large numbers of appliances reported by the men in households #6 and #7. If the data from these two households is omitted, the total for women drops to 11 and for men to 10 (Table 4).

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8 These two households were the ones with the largest numbers of appliances reported overall (household #6 reported 55 appliances and household #7 reported 50). It appears that the discrepancy between the numbers of programmable appliances reported by these two men and their partners was at least partly due to the fact that the men in both households each reported a larger number of appliances than their partners in total. In household #6, the male participant reported three stereos which the female participant did not report, and also mentioned the separate tumble dryer, while the female participant only reported the washing machine. In household #7, the male participant mentioned a video camera, a DVD player, an extra fridge-freezer and two mobile phones which his partner failed to report. These differences do not cover the whole of the discrepancy between numbers of potentially programmable appliances reported by the male and female partners in these two households. These two men did seem particularly enthusiastic about technology, while their partners were less so. It seems likely that these men both reported more appliances *and* remembered more programmable features of the appliances they reported than did their partners, because of their greater interest in technology.

Seven households referred to individuals outside the household for technical assistance or sharing of appliances. Two households (including one single household) did not refer to anyone else. Only household #2 mentioned three outside parties. (Table 5)

In some cases, appliances such as a VCR and video camera had been borrowed from other households. The household #2 empty-nesters often asked their adult sons for technical expertise, and the sons had provided "crib sheets" on how to use their DVD and their digital timers. The single woman householder in household #1 had recently divorced from her husband, but they remained on good terms, and she had asked him to help her select the AV system for her new home.

2.2.3 Comparing Ovens to VCRs

The tasks of programming a VCR and an oven are very similar cognitively, and both are examples of 'ahead-of-time' programming (Table 6). Since according to urban myth, VCRs are very difficult to program, this research choose to look in greater depth at these two structurally similar tasks, and at the participants' impressions and experiences of them.

Seven households had a VCR, and all households with a VCR programmed them. All nine households had an oven. Only four of these ovens had been successfully programmed. The research team

asked whether the users thought their ovens were programmable, although we did not independently verify their programmability. All ovens that were successfully programmed were programmed by women, with the one unsuccessful oven programming attempt was done by a man. Seven out of seven women whose households owned VCRs programmed them, versus four out of five men (Table 7).

So on the whole, it seems neither male nor female participants had been discouraged from programming their VCRs by any difficulties with usability. Both men and women were somewhat more wary about using their oven timers, perhaps because of the greater risks associated with a negative outcome. However, where this programmable feature was considered necessary to the smooth running of the household, users (in this case mostly women) braved the difficulties and learned how to make it work.

2.2.4 Fuzzy Felt Study Conclusions

My impetus for this study[9] was to further understand how gender impacted end-user programming. This research had three motivations.

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[9] To be fair, my research colleagues' key motivation was understanding Attention Investment. Attention Investment is a theoretical model for understanding how individuals make decisions to program a device which requires abstraction or use of direct manipulation (Blackwell, 2002). For instance, if one wishes to record a television show because she is going out to dinner, she can either program the VCR to record it ahead of time or wait for the show to air and press the record button just before heading out the

First, is there a difference in difficulty between abstracting over time and abstracting to simplify repeated tasks? Second, how do individual technology users share work with other members of their domestic economy? Third, what does this shared work have to say about when and under what circumstances people choose to program domestic appliances?

In regard to the first question regarding the relative difficulty of the two types of appliances, despite finding more 'ahead-of- time' appliances (100 appliances) than 'repeats-easy' appliances (64 appliances) appliances programmed to do tasks, the tasks which were programmed using these two types of devices were reported to be of similar difficulty. While both types of programming were believed to be of equal difficulty, gendered patterns of use that reflect how work is shared by members of the household.

In regard to the second question, the study showed that the domestic economy organized around the task of programming along gendered lines. The research team had expected to see gender differences in domestic programming on the basis of sociological

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door. Each of these options have associated costs and benefits which Attention Investment takes into account. These questions include: How long will it take me to learn to program the VCR? Will I be able to specify the correct channel and time on the VCR? What is the risk that it will not work for some subtle reason and I will miss my show? Attention Investment as proposed by Blackwell focused on the individual, and the risks and benefits were formulated in terms of learning and functional risks.

evidence, but the research team was unsure of which way they would fall: surveys (Antonides and van Raaij, 1998; Jowell, Brook L, Prior, & Taylor 1992) have found that women still do the majority of domestic work, but studies of computer scientists show (Camp, 1997) that the majority of programmers are men, so the implications for domestic programming were unclear. While there was no significant difference between men and women in terms of number of appliances programmed, there was a slight trend with women doing more 'ahead-of-time' programming and men doing more 'repeats-easy' programming. Similarly, women were more likely to consider appliances which could be programmed ahead of time easier to program, and men tended to rank find appliances easier to use if they permitted configuration for repeated tasks. The exceptions were the video recorder, which men ranked easier, and the security system, which women ranked easier.

An alternative way of looking at the data, in line with the distinctions made by Livingstone (1992) in her study of general appliance use, and which perhaps takes these anomalies into better account, is that men found programming AV equipment such as videos, DVDs and car radios easier. In contrast, women were more comfortable with programming devices that permitted them domestic control: alarms, ovens, heaters, bread makers, security systems etc.

This alternate way of looking at the data suggests two possible theoretical motivations for the gendered differences observed. First, in theory it is possible that women are inherently better at temporal abstractions, a characteristic that encouraged the women studied to take on responsibility for household management. Alternatively, perhaps the organization of the domestic economy encouraged the women in the study to develop expertise in 'ahead-of-time' appliances as a result of their responsibility for household management.

The data on oven timers and VCRs may offer the best suggestion of the underlying factors. While both can be programmed for 'ahead-of-time' tasks that require very similar cognitive processes, there were significant gender differences in terms of which were found easier. Women found ovens easier to program than men (7.1/10 for women, 1/10 for the one man who responded, with 10 = easiest); men found VCRs easier (6.6/10 for men, 4.5/10 for women, with 10 easiest). Given that these tasks have similar cognitive complexity and structure, and given that the men's scores for VCRs were so similar to women's scores for ovens, perhaps it is social roles that drive who programs what, rather than any inherent cognitive differences between men and women.

This study suggests programming patterns for appliances of different types are gendered, and that these patterns have

implications for design. This research demonstrates that appliances with very different purposes, such as oven timers and VCRs, can require very similar cognitive processes while programming, and yet their frequency of use was very different. This suggests that designers can learn from both successful and unsuccessful designs from other appliance categories, as well as from the domestic context in which the appliance has to operate. The rest of my dissertation will build on this to further show the gendered motivations for programming are cultural and not cognitive in basis.

Finally, there is the question of how this research relates to motivations as to how and when to engage in domestic end-user programming. The discussions about ovens uncovered stories about fear of setting the house alight, and of embarrassing dinner parties where the main course was charred by a failed attempt to program the oven. These stories explained reluctance to program ovens. The exceptions were female empty-nesters, both of whom had used the feature often when their children were still at home, as a way of providing regular meals for the family while juggling other activities. However they have both stopped using the feature now that their children have left home.

These findings suggest that even when programmable features are difficult and risky to use, users will persevere in the face of

adversity if they have a real need for the feature. However, where there is no real need for programming, users will not bother. Thus, while programmable features may be included in items like ovens and bread-makers because they are considered selling points, these features may not in practice enhance the usability of the appliances. If such features are considered desirable, or are essential (as is the case with VCRs), perhaps designers should focus on reducing the chances of failure, and/or the associated risks.

The research elicited rich contextual data that allowed understanding of why users go about making the calculations into whether to 'invest' their time in learning or using a programmable feature. These decisions were influenced by factors such as gender of participant, degree of traditionalism surrounding gender roles, and the gendering of the appliance that is itself in question. Further, programming decisions are not made in isolation; rather, they are based on their potential effect on the domestic economy as a whole. Therefore, the next area of research conducted by my colleagues and me at Cambridge involved the domestic economy.

2.3 Domestic Economy[10]

While the Fuzzy Felt Ethnography was broad in that it focused on the household's entire suite of appliances, the motivation for this research was to follow-up the earlier research with a more narrow study of gender and end-user programming in the context of a domestic economy. In particular, this research aimed to understand why women programmed more ahead-of-time appliances and whether they were better at this sort of abstraction, or whether they chose to specialize because of their roles as household managers. Consequently, this research investigated VCRs, a masculinely gendered appliance (Spiegel, 1992) which afforded programming ahead of time. A final motivation was to gain a better understanding of how programming decisions were made in the context of the domestic economy as a whole.

2.3.1 Method

The eight participant households were in or around Cambridge (UK). Potential participants were screened to ensure they were VCR-owning families with at least one child. None of the households had DVD-Rs, or PVRs such as TiVo. The age range of the 16 adult

[10] Section 2.3 is based on: Rode, J.A., Toye, E.F. and Blackwell, A.F. (2005). "The Domestic Economy: a Broader Unit of Analysis for End User Programming." CHI 2005, pp 1757-1760.

participants was from 25 to 63 years, with a mean age 42.8 years. These households included 15 children, 8 girls and 7 boys, ranging in age from 18 months to 17 years. All participants were non-programmers and non-computer scientists. Households came from a range of backgrounds, and member employment ranged from cleaners to lecturers. Three households had children under the age of six (#1, 4, 8); three had older children (#3, 6, 7); and two families had older teens (#2, 5). This research aimed to gather broad descriptive data rather than statistically significant data.

2.3.2 Procedure

Households were asked to participate in two 45-minute interviews at the beginning and end of a two-week period. During this period subjects were asked to complete a diary listing of all their recording appliance use, including start, stop, show name, and whether they were watching, manually recording, or programmatically recording. On days they did not use the VCR, subjects were asked to record why. The study took place in the evening with the intent that all household members could be at home, as requested. In reality, the adults actively participated in the study and were always present. Younger children usually participated in the early stages of the interview during which the research team asked what they did with their VCR or DVD player. However, the children often lost interest and

went back to playing midway through the session. The four teenagers (ages 14-17) were a challenge; while the research team tried to include them in the study as much as possible, only one teen completed both interviews (#7). Two were absent for both interviews but completed diaries (#5), and one completed a diary and one interview only (#1). The younger children were eager to 'be helpful', and completed diaries with their parents' assistance.

During the first session, information was collected on demographics, what recording appliances the household owned, and which members of the household used appliances for what purpose. Information was also collected on history of the appliances, including how they were obtained, how long each had been owned, and about their past history of owning similar appliances. Finally, members of the household were given an opportunity to relate key memories of each appliance's use. The team also explained how to complete the diary itself. During the second session, the diary was reviewed and discussed, along with any video-related problems or interesting situations encountered during the course of the study.

2.3.3 Results

2.3.3.1 Trading Programming Expertise

This research looked at the number of shows recorded versus those viewed in each household (Table 8). Perhaps unsurprisingly, this

research found that viewed episodes outnumbered recorded episodes in all but one household (#5). During the two-week study, VCR use for all households was reported as follows: 106 viewing episodes, 44 manual recordings, and 9 pre-recordings. Four of eight households made no pre-recordings; three households (#4, #7 and #8) made no recordings at all during the fortnight of the study; and the other five households made 3-27 manual recordings and 0-6 pre-recordings. For instance, 15 of the 27 manual recordings in household #5 were made by a teenage girl who wanted to catch up on her favorite soaps after she had finished taking school exams. That significantly more manual recordings (44) than pre-recordings (9) were made suggests a preference for manual recording.

Table 2-8. Summary of VCR viewing and recording activities

	Viewing Episodes	Viewing Errors	Manual Recording	Manual Errors	Pre-set Recording	Pre-set Errors
total	106	1	44	1	9	1
range	4- 23	0- 1	0-27	0 -1	0- 6	0-1

The data did not show many errors occurring with VCR use, but the errors provided examples of potential risks to be factored into decisions as to whether to program the device. The data revealed only one of each type of error: viewing, manual recording, and pre-

recording. The viewing error occurred because a visitor did not know how to use the AV function on the TV. The manual recording error occurred when a user forgot to press 'record' and missed 10 minutes. The pre-recording error in household #6 occurred when a babysitter unwittingly reset the VCR; after the daughter tried but failed to fix it, Mom had to sort it out. This research shows that VCR problems often occurred because of intervention by people other than the 'expert user,' which may suggest that in households that do a lot of recording, contention and confusion among different users may be significant issues.

This small number of errors suggests that these households had settled into a pattern of VCR use that they understood and with which they could cope; however, it does not mean that all household members were equally competent and willing to attempt VCR recording. Instead, this research demonstrates that responsibility for TV recording fell on individuals who had mastered VCR programming, which to some extent, they were able to trade in exchange for cooperation from other household members. Further, when people other than the household 'expert' used the VCR, confusion was a common outcome.

Household #6 illustrates this observation clearly. The VCR was mostly used by the mother and her nine-year-old son. Mom was a fan

of *Casualty*, which was shown on Saturday evenings when the family was often out. The soccer matches the son was interested in often did not finish until after his bedtime. Therefore Mom and son both had typical 'soap and sport' motivations for pre-recording TV programs; in fact six of the nine pre-recordings for which data was gathered came from this household. Dad and daughter both used the VCR infrequently, and when they did, they chose to record the programs manually. Only Mom knew how to use the pre-record function, but as the family pointed out, the numbers had worn off the VCR remote making it difficult for anyone else to learn. Mom was responsible for ensuring that *Casualty*, important soccer matches, and specific shows for her husband and her daughter were recorded. In the case of the daughter, Mom did this favor explicitly in exchange for the daughter getting ready on time for school.

While data from eight households can only be suggestive, it is interesting that mothers were responsible for 24 recordings while fathers made 11 recordings. Women were observed using VCRs as a child management tool. This is consistent with the findings of my colleagues at Cambridge and my previous research and that of others which indicate that women tend to take on the role of household manager (Webley, Burgoyne, Lea, & Young, 2001).

2.3.3.2 Parents and Children

It is surprising how poorly designed VCRs are for operation by households with children. My colleagues and I observed a 2-year-old boy kick an ejected tape into the VCR so it would start playing automatically. Most of the VCRs in the sample were stored at floor level because this is how most TV carts are designed. Unfortunately, as four of the households reported, this permits children to 'post' objects into the VCR's tape slot, which resembles a mailbox. Objects placed into the VCR included crayons, cereal box toys, jigsaw pieces and a 'jam butty' (jelly sandwich). One informant mentioned that in her sister's household the VCR was used as a piggy bank. It is amazing that a mature technology intended for the domestic environment possesses such fundamental problems. Yet, as one parent pointed out, VCRs require substantially less dexterity than a DVD player. Therefore, it was no surprise that the youngest DVD user was eight.

Older adults describe different problems such as having to crawl down to reach VCRs near the floor and finding it hard to read in dark cabinets (#2). This underlines Plaisant's point that domestic technology must be designed for the intergenerational family.

The ability to program the VCR allows the programmer to take on the role of media provider for other individual family members. This can cut across the parent/child power dynamic or complement it. The

15-year-old son in Household #2 explicitly cited the "power" it gave him over his dad as the reason he learned to program the VCR. He could threaten not to record something unless conditions were met. His family missed an episode of *NYPD Blue* due to confusion over who was supposed to adjust the VCR clock during British Summer Time. The father was supposed to adjust all of the clocks, and the son assumed this included the VCR clock. The father described himself as very "sanguine" about missing *NYPD Blue*. The interview clarified it was a mistake, but the way programming ability cut across the power dynamic impacted the conflict-resolution process. Even in this household, time-shifting (recording for later by scheduling it or pressing record) occurred to permit parental monitoring. Actually, this type of "good parenting" was commonplace in households #2, 3, 6 & 8, which is consistent with O'Brien's findings. Households with younger children (#1 & 4) accomplished the same effect, because children must ask for help to start, or in the case of our precocious 2-year-old, – to change a cassette.

The household rhythm, the pattern of when the household does what, was often echoed by VCR recording and watching. Rainy days and vacations resulted in more VCR usage. A parent in household #1 remarked guiltily that the duration of the tape represented a predictable unit of time for a parent to engage in something else or

provided a way to help a working dad control the kids (#4). Most households with younger children had explicit routines surrounding children watching (#1) or not watching (#3) TV in the morning, after school (#8), or before bed (#1,6,7). Television in the evening represented "adult time" in the words of one household member. Programmability permits time-shifting which impacts household rhythms.

2.3.4 Discussion

The families' relationships to technology were more complex than individuals programming in isolation for themselves. They formed a Domestic Economy, trading expertise for mutual benefit. As Webley puts it, "Utility-maximizing individuals can benefit… by means of gains in trade through specialization, the sharing of 'public goods' (such as housing) and economies of scale" (Webley et al., 2001). Even when a Technology Czar emerged within the household, the Czar provided for other household members' needs, impacting the whole household's technology usage. In domestic ubicomp, programming becomes a household responsibility similar to loading the dishwasher and taking out the trash. Programming is subject to the needs of the domestic economy as a whole.

The data supports the idea that individuals may look at the isolated risks and benefits of programming, but the domestic economy

must also be considered. Individual programming behavior occurs when it is strongly motivated and is considered to be relatively low risk (because of the programmer's expertise), and our participants primarily favoured direct manipulation either by watching TV live (N=106) or pressing record (N=44); occasionally, circumstances motivated a user to schedule recordings (N=9). However, social issues within the domestic economy, such as screening TV shows suitable for children or time-shifting so TV does not conflict with household activities, provide motivation to program and therefore contribute to the risk/benefit calculation. Households seem to benefit from a division of programming labor. This specialization and trading of expertise needs to be considered when trying to understand gender and end-user programming. Researchers must work with the household as an operational unit, taking into account the risk for the household as a whole, and trade it off against potential effort expended by all possible programmers.

2.3.5 Domestic Economy Study Conclusion

This research shows that households engage in programming decisions through a complex process of programming specialization, informal calculations of risks, and benefits and effort for the household. To understand domestic end-user programming, we, as researchers, must turn to the domestic economy as a broader unit of

analysis for end- user programming. Still, these cost/benefit calculations of risk depend in part on social factors surrounding technology use, including roles, power balance, and household rhythms.

2.4 Overall Conclusion

Considering these two sets of findings in concert, it is clear that programming decisions in the home are complex. Instead of individual cost/benefit decisions, decisions were made in the context of the group. Men and women are specializing in different types of programming. One can look at this in various ways—men and women specializing in different types of programming, or women programming technologies in line with their role as household manager, with men programming leisure technologies. Programming decisions are influenced by the separation of spheres, gender differences in attitudes towards technologies role and utility, and gendering of appliances themselves. This notion of specialization by gender provides the foundation on which the remainder of my dissertation is built. Having established the importance of gender as it relates to end-user programming, I will next review the literature which serves as the foundation for my dissertation research.

Figures & Tables for Chapter 2

2.4.1 Figures

Figure 2-2. (a-e). Felt board details: (a) Felt icons (clockwise from top left: Microwave, TV, mobile phone, camera, alarm clock, heating control, PC, phone, stove, and VCR in center) (b) room category board, (c) sorting board (d) 'repeats easy' board, (e) 'ahead of time' board.

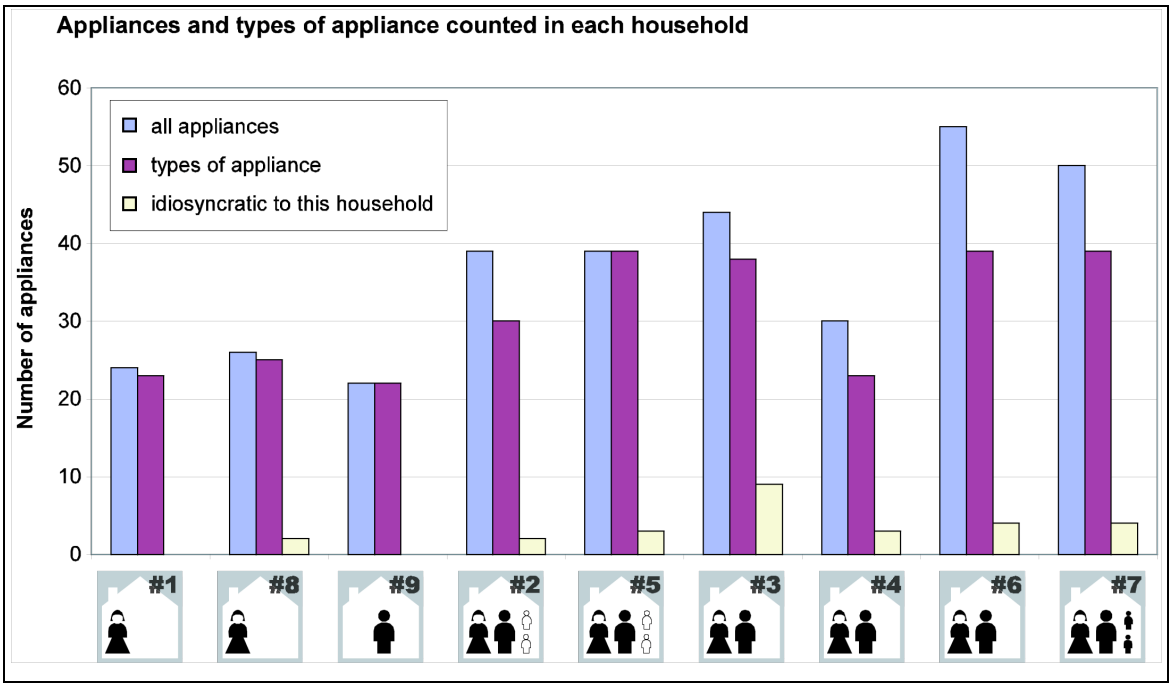

Figure 2-3: Appliances and appliance types by household

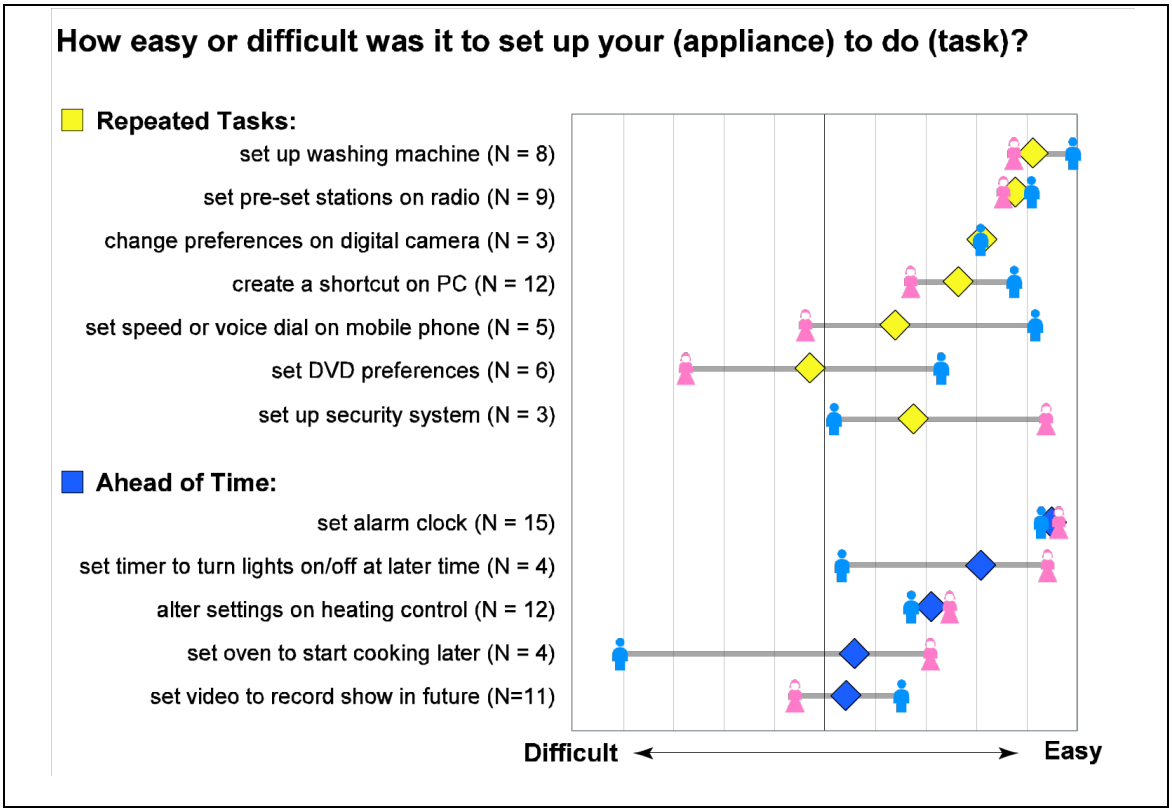

Figure 2-4: How easy or difficult was it to set up your (appliance) to do (task)?

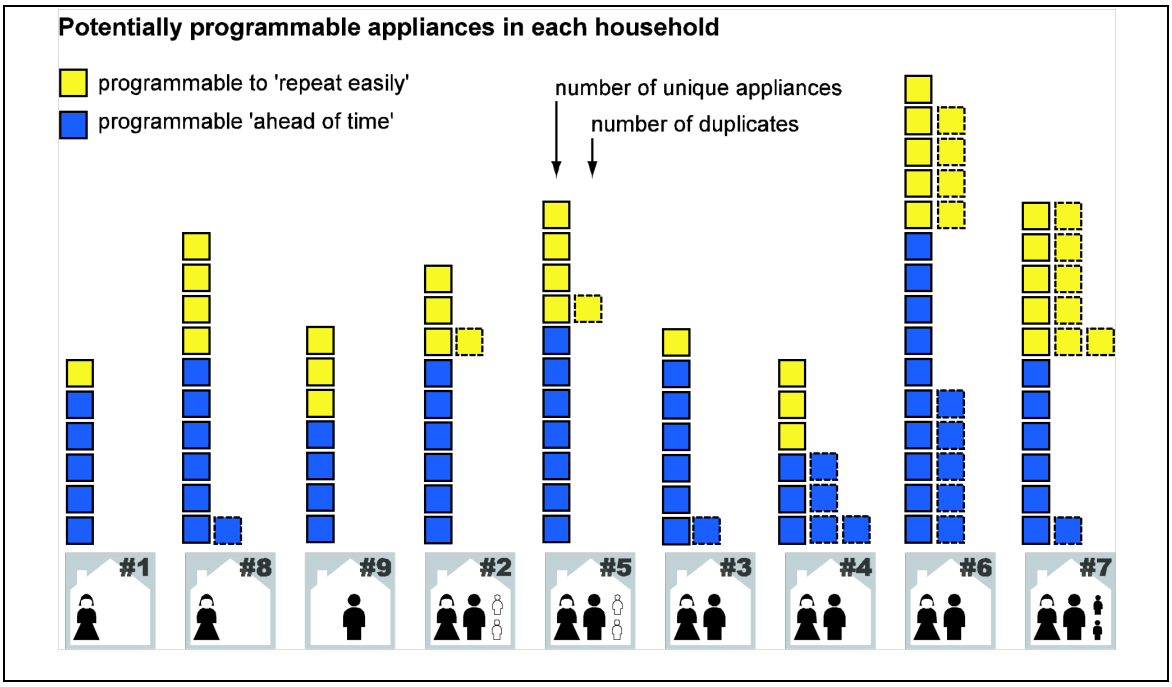

Figure 2-5: Potentially programmable appliances by household, including duplicates

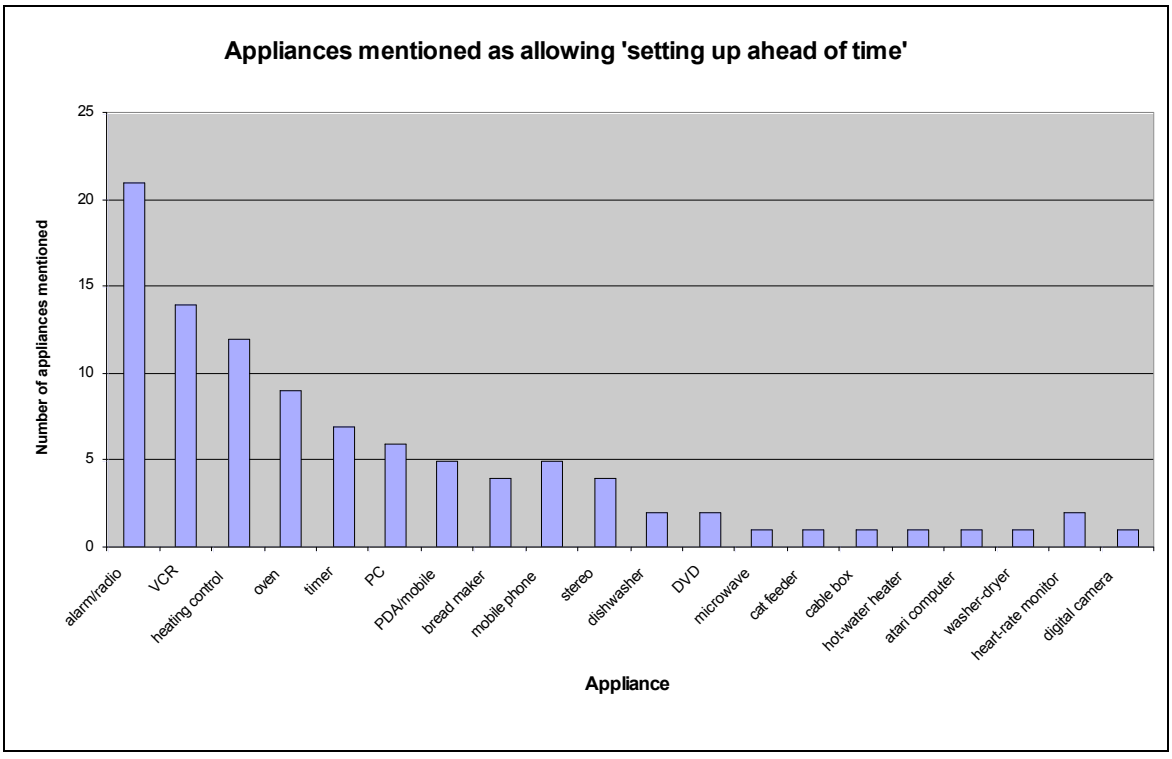

Figure 2-6: Appliances mentioned as allowing 'setting up ahead of time'

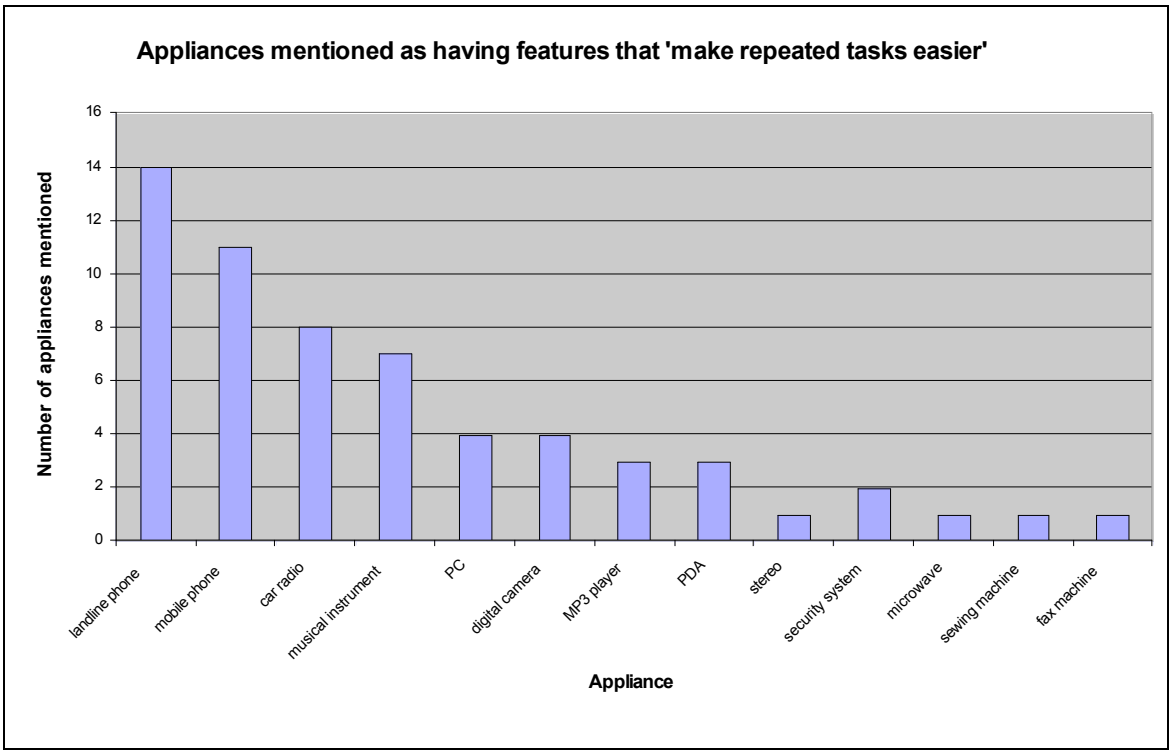

Figure 2-7: Appliances mentioned as having features that 'make repeated tasks easier'

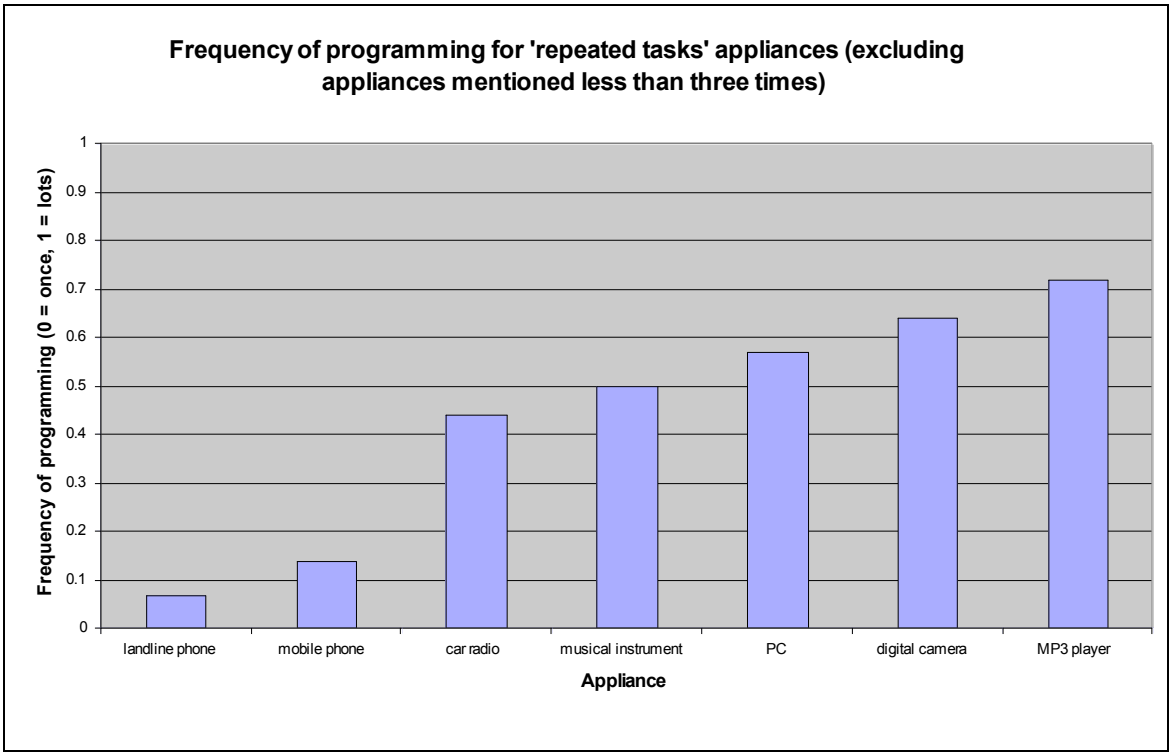

Figure 2-8: Frequency of programming for 'repeated tasks' appliances

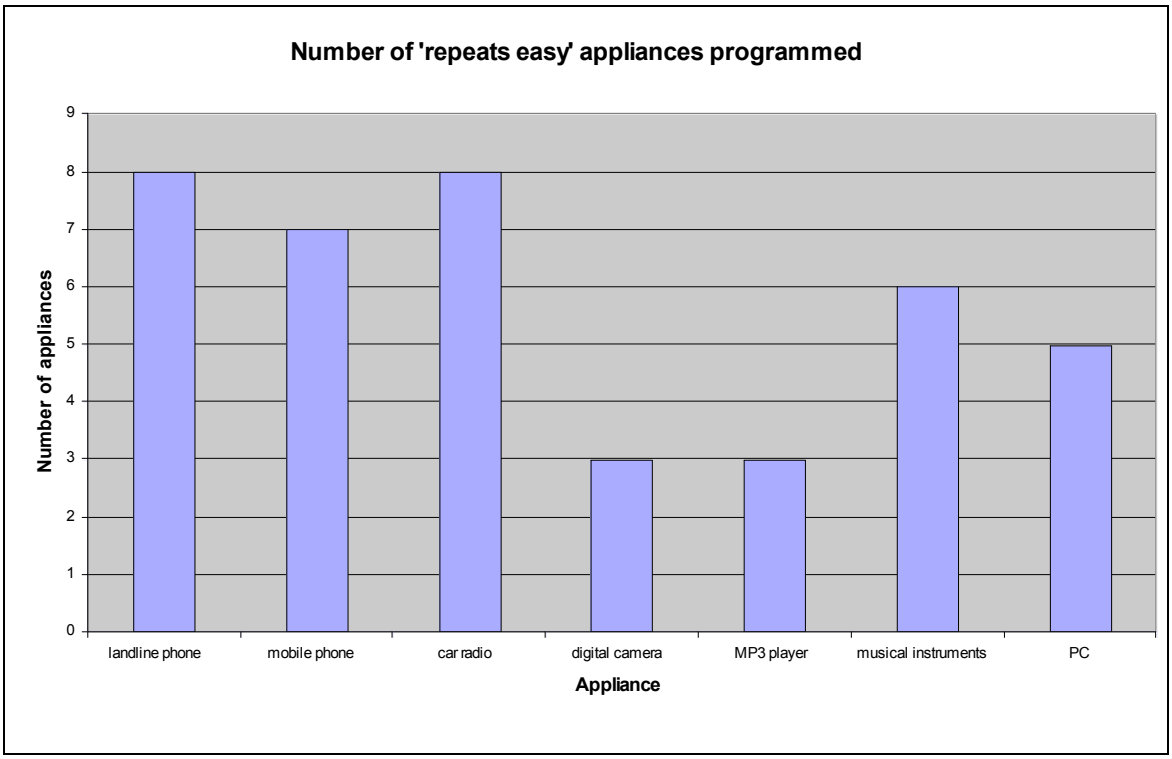

Figure 2-9: Number of 'repeats easy' appliances programmed

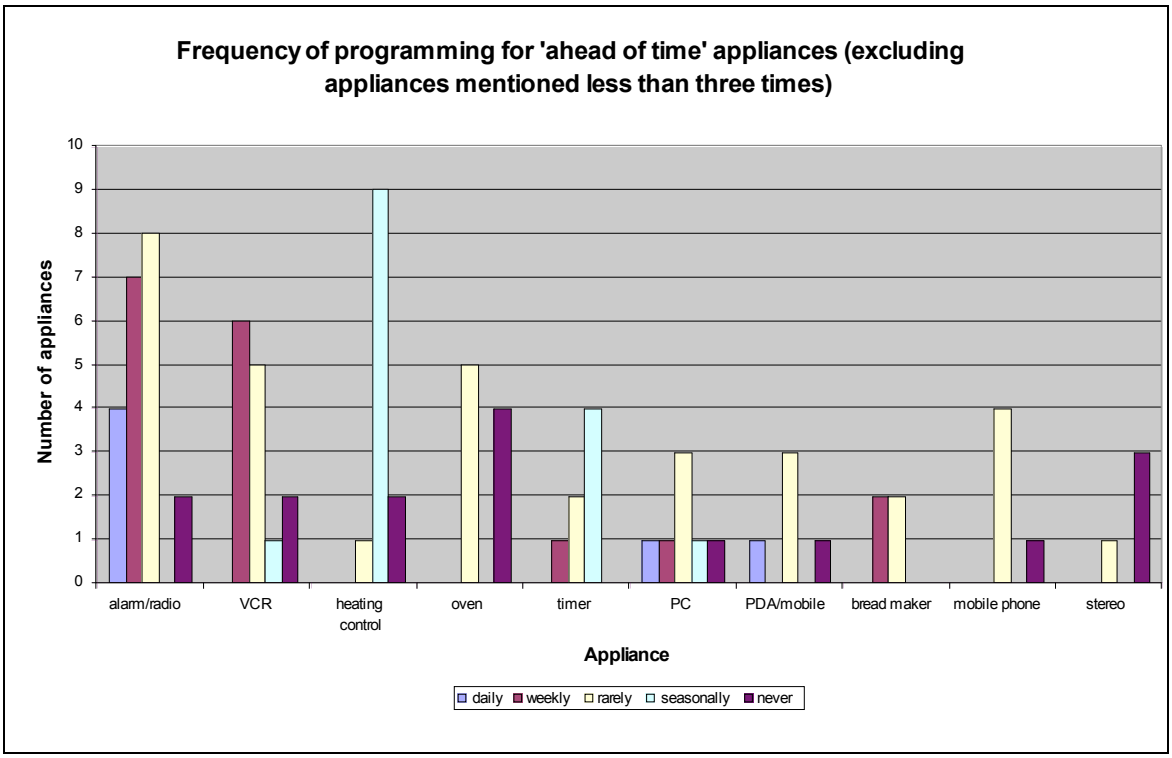

Figure 2-10: Frequency of programming for 'ahead of time' tasks

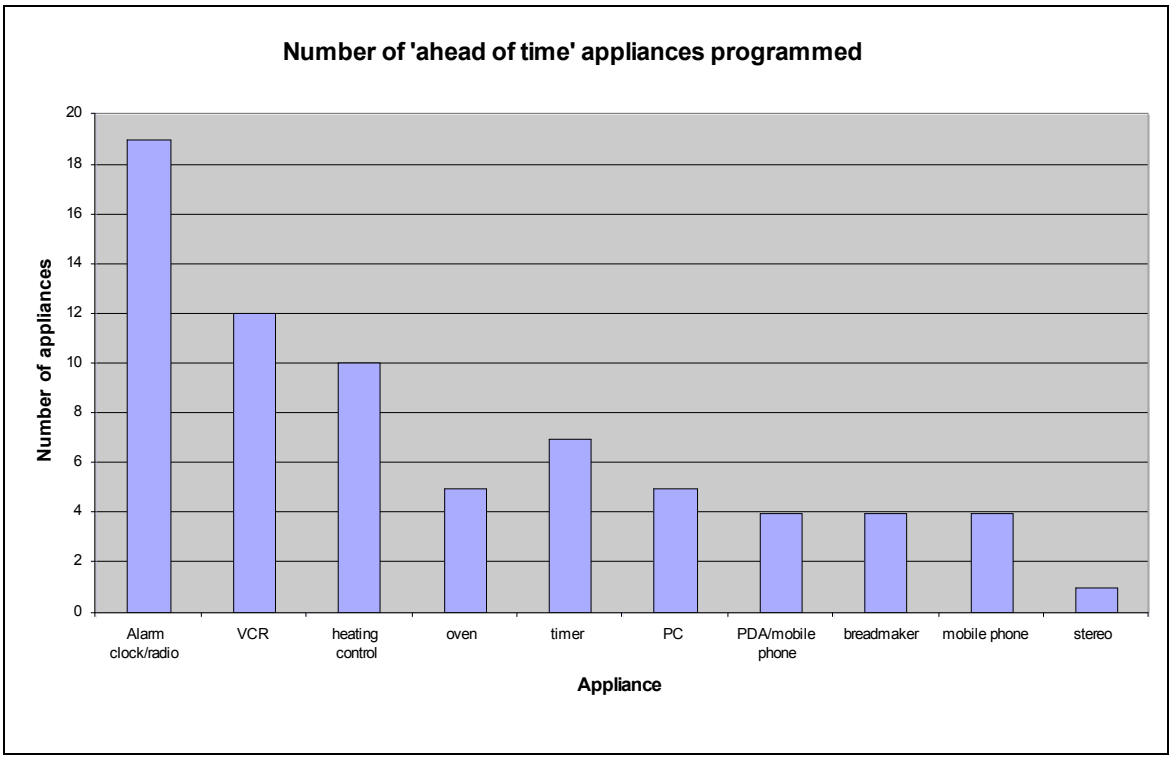

Figure 2-11: Number of 'ahead of time' appliances

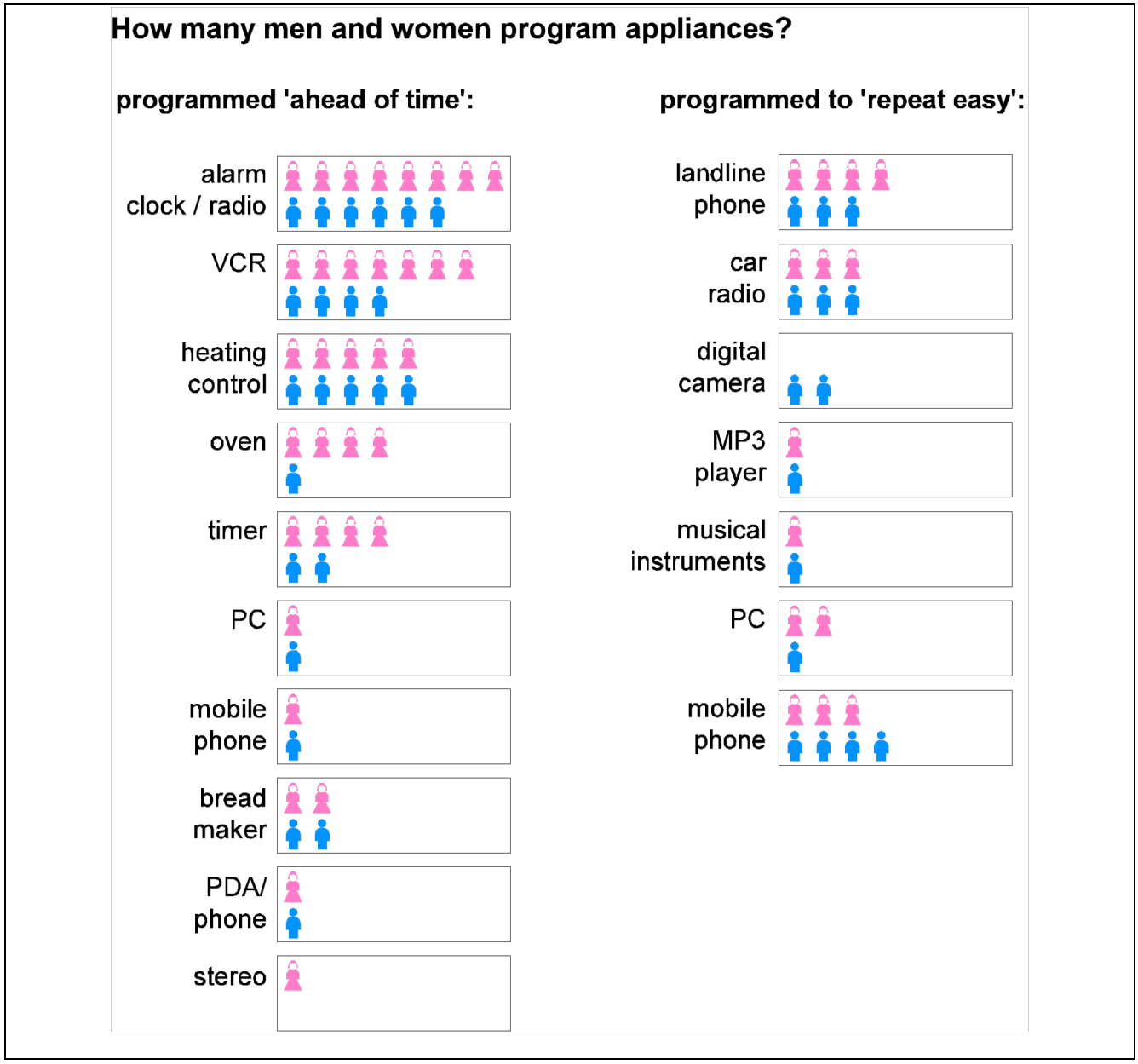

Figure 2-12: Numbers of men and women who programmed 'ahead of time' appliances

2.4.2 Tables

Table 1. Range and means for numbers of potentially programmable appliances by households

	Number of appliances/household		Number of appliance types/household	
	Range	Mean	Range	Mean
Ahead of time	4–15	7.3	4–10	5.9
Repeats easy	1–11	4.8	1–5	3.2
Total	6–24	11.9	6–10	8.7

Table 2. Range and means for numbers of actually programmable appliances by households

	Number of appliances/household		Number of appliance types/household	
	Range	Mean	Range	Mean
Ahead of time	1–8	4.7	1–6	3.9
Repeats easy	0–5	2.5	0–4	2
Total	3–12	7.3	3–8	5.9

Table 3. Numbers of potentially programmable and actually programmed appliances reported by male and female members of couple households.

Household number	Number of reported potentially programmable appliances			Number of appliances actually programmed		
	Male	Female	Difference score	Male	Female	Difference score
2	8	8	0	5	6	−1
3	10	8	+2	9	5	+4
4	7	10	−3	7	10	−3
5	12	11	+1	8	7	+1
6	24	12	+12	12	5	+7
7	18	11	+7	9	8	+1

Table 4. Appliances believed to be programmable and Actually programmed by household up your (appliance) to do (task)?

Household number	Gender (age) of participant	Number of potentially programmable appliances reported	Number of appliances actually programmed	Difference between number reported and number programmed
1	F (30)	6	4	2
2	M (58)	8	5	3
	F (60)	8	6	2
3	M (29)	10	9	1
	F (30)	8	5	3
4	M (59)	7	7	0
	F (57)	10	10	0
5	M (30)	12	8	2
	F (35)	11	7	3
6	M (37)	24	12	12
	F (30)	12	5	7
7	M (47)	18	9	9
	F (42)	11	8	3
8	F (44)	12	11	1
9	M (32)	7	3	4

Table 5. Household demographics and their "technology household"

Household number	Household members	Number in "technology household"
1	Single F (age 30)	1 (ex-partner)
2	M (58) and F (60) (empty-nest)	3 (two adult sons, one colleague)
3	M (29) and F (30) (no children)	2 (father and friend)
4	M (59) and F (57) (empty-nest)	1 (daughter)
5	M (30) and F (35) (no children)	2 (one PhD student, one friend)
6	M (37) and F (30) (no children)	2 (M's parents)
7	M (47) and F (42) (three sons, aged 9, 11 and 11)	0
8	Single F (44)	1 (niece and sometime lodger)
9	Single M (32)	0

Table 6. Comparing oven and VCR programming tasks

	Oven	VCR
Information source	Recipe	Schedule of programs
Time	Start to cook	Start to record
Duration	Cook time	Program length
Source of variability	Recipe	Schedule change
Potential calibration problem	Oven temperature	VCR clock
Consequence	No dinner; family hungry	No TV tonight; can often record later

Table 7. Comparing oven and VCR for difficulty, frequency of use, tasks and period to learn

	Oven timer	VCR
Difficulty rating (10 = easy)	5.6/10 for beginning to cook at a specified time ($n = 4$)	5.4/10 for recording shows ($n = 11$)
Frequency	Five rarely Four never	Six weekly Five rarely One seasonally Two never
Tasks	Three used timer to start to cook One tried to use timer to start to cook but failed One uses alarm Four never used this feature	11 record Two did not record shows One was uncertain if they had ever recorded a show
How many times did it take you to learn? (w/o instructions)	3/4 who program claimed they had never learned how to do it without instructions 1/4 said it took two times to do it without instructions, over 5 min. She said she does the task monthly	Mean of 2.7 times to learn how to do task without instructions ($n = 8$) (Range = 0–6 learning attempts) Three had never learned how to do the task

3 Literature Review

3.1 Introduction

My research lies at the intersection of four key areas of literature, the intersection of which has not been previously explored. First, I will look at the interaction between gender roles and the division of domestic labor in American homes. Interestingly, I will show that the historical trend toward improved technology has not decreased the amount of domestic work done by women. Second, I examine the gender-studies literature which discusses the differences in how men and women approach technology and how that technology is itself gendered. Third, I review the literature that looks at end-user programming, including factors such as gender, self-efficacy, tinkering, and the theory of attention investment. Fourth, I study the Ubiquitous Computing (ubicomp) literature focusing on smart homes and considered the absence of research looking at domestic end-user programming.

3.2 Gender and Housework

The industrial revolution resulted in a large influx of technology into the American home that greatly affected domestic work. Schwartz-Cowan argues that while domestic technology tends to

reduce work for men and children, it produces "more work for mother" because the amount of time women spend each day on domestic work has remained constant despite technological advances (Cowan, 1983). In the pre-industrial U.S., for example, cooking largely occurred in one pot over the fire; the introduction of the stove made a combination of cooking methods possible. As a result, the housewife needed to develop an increased range of cooking skills and learn to prepare a wider range of foods for her family. Rather than decreasing domestic work for women, more stringent standards of cleanliness have increased the workload (Cowan, 1983). Similarly, Gershuny's research (1983) shows that the time spent on routine housework has decreased since 1960, but Gershuny's definition of "routine housework" includes only cooking and cleaning. Consequently, shopping, travel and childcare are area areas of domestic work which both Gershuny and Cowan's research suggest have been increasing. So while appliances may have helped reduce the physical drudgery of housework, the evolving nature of the work has kept the overall time women spend on domestic work constant. At the same time, women's participation in waged work has risen dramatically.

Married women do a significant portion of domestic labor, though precisely how much is the source of much debate. For instance, Maushart (2001) claims that in the U.S., married women perform two-

thirds to three-quarters of housework and act as the primary party responsible for childcare. Berk (1985), however, reviews other American work which shows that women with the longest work week (paid and unpaid labor combined) tended to be married to men with the shortest work weeks. While this finding suggests interdependency, Berk's work also shows that the time spent by the husband on housework remains constant regardless of the wife's paid work. At the same time, women's involvement in the labor market over the last century has increased (Bureau of Labor Statistics, 2004).

The combination of these factors presents a social dilemma for designers of technology who must decide how to position themselves on these issues. Clearly, from a feminist standpoint, the issue is how to design technologies that: 1. reduce domestic work for women; 2. do not raise standards of acceptable homecare; and 3. distribute work among the household members in a manner that balances paid and unpaid employment. The gendering of these technologies is also critical, and it is the subject of the next section.

3.3 Gender and Domestic Technology Use

Every successful technology has a user, and while some technologies are used equally by men and women, others are distinctly gendered. In this section, I will discuss gendered views towards the

utility of technology as well as the view of technology as masculine culture.

Men and women approach technology differently. Livingstone (1992) has outlined a number of key differences in how men and women discuss domestic technologies. In her ethnographic study, women talked more concretely about the significance of domestic technology in their lives. They spoke of controlling situations and minimizing domestic chaos, for example. For men, on the other hand, control was more of a means to express expertise. Livingstone (1990) writes that men:

> tended to emphasize that technologies are 'purely functional,' and discussed them in terms of features; whereas, women are also concerned with the utility of objects… Their concern is how the object allows them to function in their everyday lives... They tend to refer outwards to domestic practices when justifying object use rather than pointing out its inherent properties, its modern features or its price tag. (p. 120).

For instance, the home of the future is often equipped with home control features (e.g. lights that sense homeowner's presence, or programmable blinds) which are gendered (Spiegel, 2005). For men, they can play on this masculine desire for control and mastery, whereas for women such features allow for utility and domestic order.

These gendered differences in attitude are core to understanding gender roles for end-user programming.

Not only do men and women have different attitudes toward what gives technology value, they also have different degrees of involvement in its development which shapes how they react to it. Technology is often argued to have an inherent male bias. Different schools of feminist thought attribute this to different causes. The eco-feminists view technology and society, which they conflate together, as tools created by men to control women and nature. Technology, then, is inherently patriarchal, and women act in line with biology by following their nurturing and a-technological urges. Given Strathern's research (1980) on the Hagen which shows the mapping of traits such as nature and culture to gender is culturally arbitrary, this approach is inherently at odds with presents understandings of the cultural constructions of gender. For liberal feminists, technology is gender neutral, and women's relationship to technology is determined by following gender roles. Work in this tradition has been criticized as following gender stereotypes (Wajcman, 2007), which I hope to avoid. My work builds on the concept of "technology as masculine culture" (Grint & Gill, 1995; Cockburn, 1985, 1992)[1]. It argues that the

[1] This approach too has been criticized, though contemporaneously with this dissertation. Wacjman (2007) argues Socialized feminist frameworks, of

inherent male bias of technology is in part caused by women's lack of involvement in the design of technologies because they are shaped by male power and interests (Wajcman, 1992). Technologies are created in the context of male culture and are either designed for men or to embody men's perspectives of women's needs. This, in turn, means that women are alienated by technology and define their femininity in terms of rejection of technology rather than acceptance of it (Turkle, 1988). This notion of women as intentionally defining themselves as a-technological to preserve their femininity (Turkle, 1988) is critical to understanding of programmable appliances. The "technology-as-masculine-culture" argument stresses that this is not the result of nature, but rather the result of men primarily responsible for the creation of these designs. Consequently, this perpetuates male-oriented designs which could be avoided by greater female participation in design.

Therefore, it is necessary to examine how masculine culture influences usage of programmable domestic appliances. Appliances are gendered, either entirely or based on the task (Cockburn, 1992; Berg & Lie, 1995). "White goods" (things that are traditionally white such as washers, dryers, stoves, fridges, dishwashers) for example, are

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which "technology as masculine culture" is one, fails to attend to the role of women's agency. My work, however, in chapter 6 will discuss women's agency extensively.

seen as feminine, whereas "brown goods" a phrase used to describe stereos, TVs, and VCRs that in the past were often wood paneled and brown are viewed as masculine (Spiegel, 1992). Ann Gray's research, which asked individuals to mark the gender of appliances by labeling them pink or blue also showed this division (Wacjman, 1991). The gendering of goods can change over time or by task. For instance, communication technologies are typically feminine, as married women are responsible for maintaining their husbands' social networks (Frissen, 1995). However, given that men's interest in technological mastery facilitates set up, men are often first in adopting new technologies. Yet once the technology becomes routine, it often becomes feminine. Consequently, a technology such as the phone was treated as masculine technology initially, but as it became integrated into the home, it became part of the feminine communication realm (Fischer, 1992; Wajcman, 1991). As it transitions from being masculinely to femininely gendered it looses its status as "technology", thus following the precepts of "technology as masculine culture". Further, a typically masculine technology such as a VCR can often be appropriated in a fashion that blurs the gender lines—for instance, women programming the VCR to help manage putting the kids to bed.

Appliances are gendered, and this gendering of appliances interacts with our definitions of programming. Consider ovens and

VCRs as examples of feminine- and masculine- gendered appliances respectively. While these are just two examples, my fieldwork in the UK suggests an interesting contrast in how we talk about programming and setting. The task of setting an oven to cook dinner at three different temperatures, each for a specified period of time using a small LCD panel, is arguably as cognitively complex, if not more, than programming a VCR to record one show on one channel using a large TV-sized display and yet programming of white goods is not discussed (Rode et al., 2004). Further, in most instances, the cost of incorrectly programming the appliance is substantially different. Programming the oven to ensure a timely, edible dinner for the children is usually more important than recording a TV show. My dissertation research further supports this gendered notion of programming in more detail across a broader range of devices.

A gendered notion of programming is in line with the feminist view that technology is masculine culture. This school would argue that by definition, brown goods would be technological, complex and programmable. Livingstone, for example, argues that programming allows men to express their mastery by controlling the technology. Consequently, it's no surprise that popular culture abounds with stories of women who cannot record a TV program without their husband's guidance. In talking about setting ovens rather than

programming them, women can preserve their identity as a-technological and simultaneously maintain their feminine identity. If feminine technologies are subconsciously positioned as a-technological within homes, then the scope of domestic end-user programming may be broader than one may have initially thought. Further, this broadness of scope illustrates a need to explicitly consider and understand both male and female end user-programmers and where they stand relative to programming tasks. In the next section, we will take a closer look at end-user programming.

3.4 Gender and End-User Programming

The problem with programming is that it quite often causes more work for the user than just performing tasks manually. Thus, the user has to calculate the trade-off between the probable effort involved in creating the abstraction of a program with the effort involved in doing the same task by direct manipulation. Users often ask, "how long will it take me to learn to program this?" Or, "Can I get it to do what I tell it to do?" Or, "What is the risk that it will not work for some subtle reason, perhaps with horrible consequences?" Single user's programming decisions have been cognitively modeled with a theory called Attention Investment (Blackwell, 2002) "Programming" in the context of VCRs, for instance, is defined as scheduling a recording

ahead of time, not simply pressing the record button. The model generates decisions about whether to engage in programming activity or to perform the same task by direct manipulation by comparing projected effort and risk for each. Because users' expertise at programming tasks varies, and the importance and timescale of their goals also vary, the model generates different decisions for different users, or for the same user under different external constraints. However, this model emphasizes the behavior of a single user working alone. It does not address how programming practices may change when enacted within family groups, nor is there any consideration of the genders of the participants or of the programmable appliances themselves. Further, the motivations for programming are viewed as entirely cognitive, a view that treats users as rational actors and leaves no room for cultural performance as it relates to issues such as gender.

The relationship among gender, programming, and self-efficacy[2] is the subject of work by Beckwith and her colleagues. In their earlier research, they showed, "that in the domain of end-user debugging, self-efficacy is a key predictor of females' effectiveness: females have

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[2] Self-efficacy is an individual estimate of one's likelihood of success on a given task.

lower self-efficacy than males and their lower self-efficacy is related to less effective performance" (Beckwith et al., 2006, p. 232). Their 2006 research compared two spreadsheet designs created by the authors — a low-cost method which made it easy to tinker, and a second high-support method with lots of scaffolding designed to encourage low self-efficacy users. Their research shows how the factors of tinkering, reflection and self-efficacy can combine in multiple ways to impact debugging effectiveness differently for males than for females. Tinkering here means playful experimentation, which is thought to be educationally beneficial (Rowe, 1978) as well as one technique for learning to program. Their findings showed that males tinker more, but that tinkering was tied to decreased likelihood of success for males in debugging. When presented with the opportunity of low-cost tinkering, males often did it repeatedly, which promoted poor understanding. Women, on the other hand, tinkered less, but the tinkering they did was more effective. Tinkering combined with pauses encouraged reflection, which was universally helpful, and women were more likely to pause to reflect. Their research also showed an increase in self-efficacy for women in the low-cost condition, but showed a dramatic decrease in post-task self efficacy in the high-support condition. Beckwith and colleagues suggest, “One possible conclusion is that the high-support females did not perceive tinkering as helpful

for understanding how their debugging environment worked. Therefore, the more they tinkered, the more it reinforced their perception of their inability to understand what was happening in the environment" (Beckwith et al., 2006). In the high-support condition, there "was a higher user-action cost, requiring more clicks, reading and choice of features to use," suggesting perhaps that extraneous technological complexity might decrease self-efficacy. These women may have interpreted their need to experiment repeatedly as undesirable, even if it promoted learning, which certainly has important implications for design of domestic appliances where a woman who looks uncertain may find her partner more likely to take over.

Regardless of how it is gendered, tinkering is itself the subject of some confusion in the literature, so it is worthwhile to expand on it briefly. As Faulkner (2000a) points out, tinkering is considered a feminine approach for software development. Formal software-engineering practice teaches a more structured approach which is typically gendered masculine. Both hacking (Hapnes & Sørensen, 1995) and professional software development require a mixture of masculine and feminine programming styles (Faulkner, 2000b). Interestingly, developers in Faulkner's study (2000a) complained that adherence to formal methods hampered their creativity, and a result,

they expressed a preference for the trial and error approach. Despite tinkering being characterized as feminine, tinkering and taking pleasure in technology are argued to be core to how men relate to technology (Klief & Faulkner, 2000). In discussing the inherent contradictions of these attitudes toward programming styles Faulkner (2000a) reminds us that these dualisms are con-constituted by evolving factors related to engineering and performance of gender.

Regardless of how it is gendered, tinkering is critical to software development both professionally and as an avocation as shown in Beckwith's end-user programming research. Tinkering is often linked to opportunistic play with technical toys in childhood. Klief and Faulkner (2000) use Morrow's argument to assert that boys growing up with more 'permission to play' to are given an advantage with regard to technology. As adults, Faulkner's research (2000b) shows that engineers continue to experience programming as a pleasurable and playful interaction, consistent with their desire to have control and mastery of appliances as discussed above. Women, on the other hand, have less free time (Deem, 1986). While men as workers define their non-work time as leisure, no-such parallel traditionally exists for women because domestic work tends to extend into the evening and weekends. Faulkner (2000b) uses this observation to argue that men have the luxury of spending time programming as they do not have

the same domestic responsibilities. This suggests that the programming of masculine domestic appliances may be a luxury for which women do not have the time, whereas they 'master' feminine appliances in the course of routine domestic work consistent with their task-oriented focus. Further, a lack of play-time will hamper women interacting with masculine appliances both by putting girls behind boys in terms of childhood exposure and in terms of adult practice.

Not only does the domestic environment affect time available for programming, but additional work suggests the social context of the situation is relevant. In his literature review, Huff reports on a related finding by Robinson-Staveley and Cooper, whose study showed that college-age female computing novices were less successful and experienced greater situational stress when performing tasks in the presence of another person, than those completing the task in private (Huff, 2002). In a follow-up study, men and women were asked to complete a task; half completed the task in private and the other in public. People in one condition were told the task would be easy whereas the other was told it would be difficult. There were no gender differences for the task in private or in public, but there were differences in terms of expectations. Those who expected success did better in public than in private, and conversely those who expected to fail preferred to do it alone. Consequently, the social environment that

shapes these expectations of success or failure is likely to be key to understanding domestic end user programming.

Beckwith, et al.'s and Robinson-Stavely's research both focus on users in a laboratory setting. Both are removed from the reality of end-user programming as well as in-home tinkering and issues of self-efficacy, in particular. The issue of programming inherently gendered technologies is not addressed. Further, programming in both of these studies was done by isolated users, and so it is unclear how gender roles play out within the social system of the family. This establishes a strong need for studies of end user programming in the home such as mine which contextualize the domestic environment.

3.5 Ubicomp in the Home

The home of the future needs to be controlled, but programming is only one approach for configuration. There are many large smart-home projects which use a multitude of approaches to configuring the smart home: the Microsoft EasyLiving project (Brumitt, Krumm, Kern, & Shafer, 2000); the Aware Home at Georgia Tech (Kidd, & et al., 1999); the House_n project at MIT (Intille & Larson, 2003); the Orange-At-Home project at the University of Surrey (Hamill, 2001); the AutoHAN project in Cambridge (Blackwell & Hauge, 2001a); and the Neural Network House at University of Colorado, Boulder (Mozer,

1998). The particulars of the projects vary, but none focus directly on end-user programming in the home. Media cubes, a project loosely affiliated with the AutoHan project, however, did allow users to perform basics functions with AV equipments (Blackwell & Hauge, 2001b). While the large smart- home projects tend not to focus on smart-home control via programming, there are a number of smaller projects where individual applications or functions of the smart home are programmed. (e.g. Newman & et al., 2002; van de Sluis, Eggen, Jansen, & Kohar, 2001; Troung, Huang, & Abowd, 2004; Hyun Chung & et al., 2003). Van de Sluis et al. (2001) created a tangible artifact to allow a user to set up phone calls and movies to start in one room and continue in another, whereas Truong and colleagues (2004) used magnetic poetry. Other research focuses on scenarios of harmonious family life that allow users to control home functions including home stats, information, communication and entertainment (Hyun Chung & et al., 2003). This category of research strives to provide user interfaces for the complex systems being designed for the home.

As I mentioned earlier, the ubicomp research is primarily related to systems development and does not address how programmable devices are used in regard to gender or the social dynamic of the home. Gender plays are role in power, roles and responsibilities, idenity and authority in the home all of which influence technology

use. Without an understanding of how gender relates to domestic end-user programming given the state of the art of modern end user systems, how can ubiquitous computing technologies that are appropriate for the work and gender dynamics of the home be created? More specifically, how can technologies with explicit social agendas such as addressing the continued disparity in performing housework be created. Given the above research on gender studies and end-user programming I have established a need for studies to contextualize the activity of domestic end user programming, inform the design of these home control systems.

3.6 Summary

The ubiquitous computing literature attempts to create the smart home of the future without a discussion of how these homes will be gendered. Gender is key to both housework and the use of domestic technology. It is through programming one is likely to do the future work of keeping the home in order, and yet while the end-user programming literature acknowledges the importance of gender, its role in programming the home of the future has yet to be addressed.

Ideally, in regard to my research questions presented in the first chapter, my research will make four contributions to the field. First, it will provide evidence for the gendering of programmable appliances,

and it will establish the relative difficulty of programming these appliances. Second, my research will show that users have lower self-efficacy when interacting with cross-gendered appliances. Third, it will establish that increased technological complexity is met with a decrease in self-efficacy for women and provide insight into how core features core are perceived relative to "bells and whistles" in terms of self-efficacy. Fourth, it will explore how the social dynamic of the household may interact with how women learn to program via tinkering. In this way, my research will contribute to both our understanding of how to design domestic appliances as well as how men and women approach end-user programming.

To answer these questions, I conducted a 20-household study that examined the role of gender in programming of domestic appliances. In the next section I shall discuss my methodology for conducting the study and my approach to analysis.

4 Study Design and Methods

4.0 Introduction

Building on my previous work, in this study I explore the answers to my research questions as I outlined in Chapter 1. This chapter describes the population selection process and the techniques I employed to both collect and analyze my data.

4.1 Site Selection

My research to date had demonstrated the importance of understanding programming decisions in the context of the domestic economy, for instance documenting gendered patterns surrounding the programming of domestic appliances (Rode, Toye, Blackwell, 2004a&b). In particular, I observed the use of the VCR, a masculinely gendered appliance (Spiegel, 1992), by women for the traditionally feminine task of child caring.

Based on my research questions, I determined that my fieldsite needed to be homes of users of domestic technologies. I was then faced with two key questions: what types of domestic technologies should be studied, and then determine the characteristics of the homes in which I would study them. I chose to focus on safety and security practices in the home, which I believed to be highly gendered. I conducted my research in conjunction with my employment at

Symantec, the maker of the Norton product suite. These consumer products, such as Norton Anti-Virus, help provide consumers with privacy and security protection. Researching consumer needs in a domestic setting rather than in a laboratory allowed for greater understanding of the everyday realities of social practice, physicality, financial realities, and temporal limitations:

- The social environment of the home: unlike laboratory studies which focus on isolated users, real products would be used by entire households. Most importantly, these multi-person settings would allow me to observe the gender dynamics of the home.
- The physical environment of the home: in contrast to the newness of the purpose-built usability laboratory, the technologies would be integrated into the infrastructure of the home, which is built up gradually over time. Additionally, studying technology use in the home meant I could understand how the usage of space in the home affected how and where these technologies were used and how these technologies affected the use of space.
- The fiscal environment of the home: decisions to protect one's computer system are made within the context of the financial limitations and priorities of the household; as such, households

may elect to protect themselves using licensed software, freeware, no software, or a combination of options.

- The temporal environment of the home: rather than exploring technology use at a specific moment in time, selecting households with different degrees of experience with security software allowed me to watch the usage of the technology unfold—from its transition from newly installed product, to something installed on the computer running in the background, to something requiring annual renewal, and finally, to the consequences of this decision. Further, as my early research on VCR programming suggests, household rhythms influence technology use, e.g., seasonal variations within the school year and daily patterns of work and school.

Studies in homes allowed us to understand how each of these contexts affect security and privacy management settings.

Studying security use at home provided the ideal opportunity to explore the research questions set forth in chapter 1 of this dissertation. As I have stated earlier, computing is a masculinely gendered communication technology (Spender, 1995), and like the phone and television, its image may change as it matures and becomes increasingly integrated into domestic routine. Computing may also, like use of the VCR, be used as tool for enacting gendered roles

like childcare. As such, issues of home privacy and security provided an appropriate context for focusing on gender roles in domestic technology use. Further, security and privacy are achieved through a variety of tools—spyware, anti-virus, anti-spam, anti-phishing software, each of which needs to be installed, configured, and programmed. Most often, these tools are combined with social practices including household norms and individual online-safety customs.

In selecting homes in which to study privacy and security practices, four key issues emerged. First, consumers vary significantly in terms of overall level of domestic technology–from early adopters to those who only adopt mature technology. Second, regardless of levels of sophistication in domestic technology, there is the issue of determining how the technology is used and situated. It is necessary to determine whether a household has masculine or feminine technologies, whether the technology is sufficient complexity to allow for programming, and finally to determining whether the technology is used either manually or programmatically. Third, households vary in their adherence to traditional gender roles, which is likely to factor into how technology is gendered, and how a household member's relationship to technology is constructed. Fourth, a variety of household structures exist, (families with children, singles,

roommates, gay couples, etc.) each of which presents different opportunities for construction of gender roles and technology. I sought to recruit a population that included households with attributes representative of the extremes of each of these different attributes of the study population, (see Figure 4-1 and Figure 4-2 which show participants' traits in each of these dimensions).

I conducted the majority of this research in Silicon Valley (including San Francisco, Oakland, Berkeley, and San Jose) with a few households in the greater city of Los Angeles and Orange County (these are labeled Santa Monica 1-6). Both areas, as high tech centers that include Symantec offices, enabled me to readily access early adopters of novel or newer domestic technologies. As anthropologist Laura Nadar's research (1997) suggests by studying such cultural elites insight is gained into technology practices for all technology users. Additionally, similar to Darrah, English-Lueck, and Freedman's research, selection of Silicon Valley early adopters enabled me to see how boundaries of work and home are renegotiated in response to new technologies (2001); active negotiation within the spheres of home and work was especially valuable because of the complex relationships of gender and technology use across public and private spaces. Additionally, the San Francisco Bay area and Los Angeles area have extremely varied populations (ethnically, both have large Persian and

Latino communities and politically, both areas reflect a variety of political views). As such, residents of these areas are likely to have different levels of adherence to "traditional" gender roles, which may impact the gendering of domestic work. At the same time, there are local populations for whom technology is less central to daily life, such as individuals who work outside the technology sector. Drawing on both highly technical complex systems and basic set-ups allowed me to understand how the degree of technological complexity interacts with gender and domestic programming.

This also allowed me to compare traditional and more modern attitudes towards domestic work and to look at patterns that emerge in terms of domestic programming. Looking at technology use in such a diverse set of homes enabled me to explore the extremes of gender attitudes and technological savvy. In addition, I was able to see how these attitudes interacted with programming and configuration of security technologies.

4.2 Data Collection

In order to learn about domestic technology, I employed an ethnographic approach which is both commonplace within the field of HCI and appropriate for my specific research questions. I investigated the social, physical, fiscal, and temporal environments in which

households made privacy and security decisions and applied appropriate configuration and programming technologies.

While the field of HCI employs a host of techniques, studies of domestic technology use rely heavily on ethnographic approaches (O'Brien & Rodden, 1997; Mateas, et al., 1996; Logan, Augaitis, Miller, & Wehmer, 1995; Kraut, et al., 1996). Quantitative approaches may give statistically powerful replies to specific questions, but careful thought must be given to the construction of those questions. In order to even ask precise questions regarding the potential relationship between gender and domestic technology use, for example, one first needs to understand how these technologies are used in the varied context of daily life. That said, I argue that my specific research questions regarding cultural beliefs surrounding gender roles and programming can only be answered through qualitative tools. Interviews and observations conducted *in situ* allowed for greater understanding of privacy and security use issues less prohibitively than lab-based studies. Moreover, in situ studies better allowed me to explore the social, physical, fiscal, and temporal environment in which households were making privacy and security decisions, and configuring and programming technologies. I made every effort to use "thick description" (Geertz, 1977) of observed behavior, combined with interviews, to understand each of these issues.

In order to understand the relationship between gender and end-user programming in the household, a variety of perspectives was required. Interview subjects are notoriously poor at accurately answering hypothetical questions such as why they do things or how they would behave in a particular situation (Dillman, 2000). Consequently, expecting interviewees to accurately explain how gender impacts domestic programming would be unrealistic. That said, listening to how respondents discuss the role of gender–even if they are unable to accurately describe their behaviors–led to a better understanding of their implicit beliefs. Moreover, discussions with the household as a whole, combined with observations of behavior, allowed me to understand the role of gender through interviews with male and female householders. Accordingly, I employed standard ethnographic techniques (Strauss & Corbin, 1990; Loftland & Loftland, 1994) for my data-collection. The next section includes a discussion of approaches used to learn about the household members and their technology use, along with a concluding summary of my fieldwork.

4.2.1 Learning about the Household Members

In order to gain access and build rapport with household members, I engaged in a number of different activities. Entering their homes as both a guest and researcher from a company paying for their time, my

primary goal was to build trust and establish a position beyond "guest" status. Approaches included:

- **Bringing dinner:** When making an appointment for our first meeting I offered to bring dinner, as was done in the HomeNet project (Keisler, Zdaniuk, Lundmark, & Kraut, 2002) and my earlier research (Rode & et al., 2004). Doing so not only allowed me to contribute to the basic functions of the family caring for its members, it granted interviewees a measure of control over the initial meeting (rather than my being stranger invited in and then immediately taking control of the setting in order to interview). Bringing in dinner also helped create a more relaxed social environment in which to build mutual trust.
- **Setting tables, washing dishes, and taking out the trash:** Typically, first-time guests are banned from performing "chores" within the home. So, helping interviewees with dinner—before, during, and after—helped position me as a contributing member of the household. The gesture also allowed me to bypass the social deference that often prohibits frank and open conversation between hosts and guests and helped me establish equal footing with household members. (It especially helped thwart conventions that disallow correcting or explicitly disagreeing with what the guest is saying.) Finally, it helped bridge the subtle

gap I sometimes perceived between my status as a career woman and the status of some of the stay-at-home moms I encountered. My willingness to literally get my hands dirty and participate in the work of the household enabled me to better relate to housewives in particular (as Chapter 5 will show), by lessening the potential tension caused by my having thus far rejected a traditional feminine role in favor of a career. In short, taking part in these simple activities helped me establish and maintain rapport with all household members.

- **Interviewing:** Adult family members were usually independently interviewed regarding their usage of and attitudes towards security and privacy technologies. Interviewing them independently allowed me to understand potentially conflicting views, and because the other partner was not present, there was less need for tact or avoidance of issues that might have led to potential conflicts.
- **Observation:** In addition to discussion of attitudes and beliefs regarding common practice in using privacy and security software, I was also able to observe individuals using or demonstrating the use of technologies. I was also able to observe real world deployments of technology and how they were set up.

- **Free software and a chance to change the world:** Despite conducting these interviews on behalf of a software manufacturer, I presented myself as an independent researcher tasked with providing constructive feedback to integrate into technology solutions to privacy and security problems. This was facilitated by giving out my university business card which established my independence as an objective neutral party. As a result of the camaraderie I established with my participants, ”telling corporate America what it was doing wrong” became a shared, if unspoken, objective. Additionally, my company provided free software (or a cash incentive) to compensate participants and motivate them to explain some of the problems participants were having. All of this gave me insight into what was conceptualized as technology, how technology use changed over time, and how its uses were gendered.
- **Ongoing technical support:** Finally, by providing contact my information and offer to supply for ongoing technical assistance, I was able to see how household members formulated descriptions of problems they were encountering though few of the participants took advantage of the offer for support. Despite this I was still able to see temporal patterns in software usage

and how fiscal realities affected decisions to renew their software licenses.

4.2.2 Learning about the Household's Technology

Not only was it vital to understand the social dynamic of the home and become integrated into its dynamic, I had to become familiar with the technology artifacts contained within each home. To achieve this goal, I used a number of approaches:

- **Technology Tours:** I asked the householders to give me a tour of the technology artifacts as related to computer safety and security in their home, a technique that has been used successfully in the HCI literature (Kiesler & et al., 2002). This allowed householders an opportunity to show me their in-home technologies; how they were used; and how the technologies became an integral part of their lives.
- **Photographing Key Artifacts:** As I got to know household members, unexpected non-technology artifacts, core to their technology usage, were sometimes mentioned. For instance, early in the study I asked one woman to show me her password list. This turned out to be a stack of index cards, each of which specified 10 to fifteen passwords. It became evident that the woman was managing several hundred passwords in total, and that this index had gone through several iterations. Her reliance

on this artifact was critical to my understanding of her aversion to password management tools.

- **Screen capture:** In some homes, with the consent of household members, I was able to use a screen-capture program to record their interactions with the computer as a supplement to my field notes and audio recordings. Given that I was observing their computer use from several feet away, it was not always possible to see the content of the small alert dialogs that are so critical to using computer privacy and security applications. Screen capture allowed me to understand the context of behaviors and to observe when these notices were acted upon and when they were not. Despite these benefits, I was forced to abandon this approach for the later interviews as the technology proved too unstable and time consuming to fix which damage rapport.

In this fashion, I was able to collect data on the household members, their activities, and their technologies, all of which allowed me to better understand gender and end-user programming.

4.2.3 Data Gathered

Twenty households were interviewed on their privacy and security practices. These participants came from three geographic areas: households 1-12 were located in the greater San Francisco Bay area

(bounded by Oakland, San Jose and San Francisco); households 14&15 were in Orange County; and the six Santa Monica households (SMO1-6) were in the greater city of Los Angeles. While only those who lived in the household were interviewed, the privacy/security roles of those who lived outside the home were discussed.

In total, 50 individual interviews were conducted–19 with adults and 31 with children. Primarily, adults were interviewed individually, though logistical constraints resulted in two couples being interviewed together (HH14-Baja, HH15-Faye). I acted as the lead interviewer throughout but brought a team with me to assist.

I led the group phase of the interview, followed by an additional one or two individual interviews. As we only had access to the participant's home for a maximum of two hours, some interviews were conducted simultaneously by my colleagues. Generally, I interviewed most all of the female participants as well as the males in households where they were the only adults. In households with multiple adults, my colleagues usually interviewed male participants, and they were completely responsible for interviewing the children. I provided my colleagues, all of whom were trained in lab-based usability interviewing, with additional guidance on fieldwork, fieldnote writing, and a script for conducting the semi-structure interview. The second column Figure 4-2 is annotated with a star if the interview was

conducted by someone other than myself. I used colleague's fieldnotes to supplement mine for analysis along with the audiotapes of the interviews. Ultimately, I developed more rapport and greater intimacy with the female participants, a fact that is reflected in my analysis.

Figure 4-1. Compositions of the twenty households:

Household	Marital Status	Full time Adults	Children	Computers	Operating System	Used Security Software	Used Norton	Used Symantec
1	Married	2	3	5	Mac & Server	Y	N	N
2	Married	2	0	4 +old	2 PC, 1 Mac, 1 Mac/PC	Y	N	Y
3	Married	2	2	2	PC	Y	N	N
10	Separated	1	1	1	PC	Y	N	Y
4	Living w/ Partner Unmarried	3	0	4	PC	Y	Y	N
6	Divorced	1	2	2	PC	Y	Y	N
7	Married	2	2	5	PC	Y	Y	N
12	Divorced	1	2	2	PC	Y	N	N
11	Divorced	1	1	2	PC	Y	Y	N
9	Divorced	1	2	4	1 Solaris, 1 PC/Java/Solaris, 2Mac	Y	N	Y
5	Married	2	0	3	Mac & PC	Y	N	Y
8	Getting a Divorce	1	2	3	PC	Y	Y	N
14	Married	2	2	2	Mac	Y	N	N
15	Married Couple w/ Adult Son	3	0	4	PC	Y	Y	N
SMO1	Single Woman	1	0	2	Mac	Y	Y	N
SMO2	Married Man	1	0	2	PC	Y	Y	N
SMO3	Single Man	1	0	2	PC	Y	Y	N
SMO4	Single Woman	1	0	1	PC	Y	N	Y
SMO5	Single Dad w/ Roommate	2	1	3	PC	Y	Y	N
SMO6	Roommates	5	0	9	PC	Y	Y	Y

Figure 4-2. Adults demographic characteristics:

HH	Name	Age	Role	Sex	Profession	Employ-ment Status	Ethnicity/ Additional Languages	Household Income	Highest Completed Education
1	Kristin	45	Mom	F	Designer	Self Employed	White	100k+	Bachelors
1	Frank*	48	Dad	M	Engineer	Full Employed	White	100k+	Bachelors
2	Javed	40	Dad	M	Software Engineer	Full Employed	White	100k+	Masters
2	Karen	36	Mom	F	EMT Student	Student	White	100k+	Masters
3	Christina	49	Mom	F	Office Manager	Self Employed	White	Decline[1]	Masters
10	Lori	42	Mom	F	Software Marketing	Full Employed	White	100-150k	Bachelors
4	Ila	75	Mom	F	Teacher	Retired	White	75-99k	Masters
4	Fred*	83	Ila's Partner	M	Engineer	Retired	White	50-74k	Bachelors
4	Louis*	48	Ila's Son	M	Sales Person/ BA student	Full Employed	White	Decline[2]	Associates
6	Yan	40	Mom	F	Biotech Alliance Mgr	Full Employed	Asian/ Chinese	150-249k	PhD
7	Kathy	41	Mom	F	Product Researcher	Self Employed	White	250k+	Bachelors
7	Tom NI	45	Dad	M	Software Consultant	Self Employed	White/ French	250k+	Masters
12	Eric	57	Dad	M	Broadcast Engineer	Full Employed	White	75-99k	Bachelors
11	Lisa	39	Mom	F	Mental Health Provider	Full Employed	White	50-74k	Masters
9	David	37	Dad	M	Computer Systems Architect	Full Employed	White	150-249k	Masters
5	Samir	32	Husband	M	Sr. Demand Planning Analyst	Full Employed	Indian Sub Continent	150-249k	Bachelors
5	Rati*	32	Wife	F	Sr. User Researcher	Full Employed	Indian Sub Continent/ Punjabi	150-249k	Masters

[1] Office manager living in an expensive looking home in a very prosperous city in Silicon Valley.

[2] Recently divorced man who had been laid off. With plans to complete his bachelor's degree, he was living with his parents and working in sales while looking for an engineering job.

8	Aileen	43	Mom	F	Masters Student	Student	Pacific Islander	Unknown[3]	Bachelors
14	Barbara +G	47	Mom	F	Writer/ publicist	Self Employed	White	150-249k	Bachelors
14	Ken +G	51	Dad	M	General Contractor	Self Employed	White/ Spanish	150-249k	Bachelors
15	Manny +G	85	Dad	M	Banker	Retired	White	25-49k	Bachelors
15	June +G	82	Mom	F	Homemaker	Retired	White	25-49k	Some College
15	Richard	47	Son	M	Home Depot-Locksmith	Part Time	White	25-49k	Associates
SMO1	Miranda	50	Single	F	Library Analyst	Un-employed	White/ German	50-74k	PhD
SMO2	Rajesh	36	Husband	M	Professor	Full Employed	Indian Sub Continent/ Hindi, Bengali	75-99k	PhD
SMO3	John	60	Single	M	Lawyer	Self Employed	White/ French	Declined[4]	JD
SMO4	Sara	32	Single	M	Production Coordinator	Full Employed	White/ Spanish	25-49k	Bachelors
SMO5	Lashawn	28	Dad	M	Service Specialist	Full Employed	Black/ Japanese	50-74k	Some College
SMO6	Dan	24	Room-mate	M	IT Consultant	Self Employed	White	100-150k	Bachelors
SMO6	Shawn	27	Room-mate	M	Nitrous Tech (cars)	Full Employed	White	25-49k	Some College
SMO6	Roy*	26	Room-mate	M	Structural Engineer	Full Employed	Pacific Islander/ Pilipino	50-74k	Bachelors

Key:

* Interview conducted by colleague

NI Individual was not interviewed

+G Interview was a group interview

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[3] Woman was in mid divorce and negotiating her alimony. She described her husband's income as "high"; she, however, was a student, and her own income was low. Terms of the divorce agreement specified that the children would live in the home full time with parents switching homes to care for them. Prior to divorce appeared upper-middle class.

[4] Semi-retired lawyer doing a great deal of pro-bono work. Had a mid-sized home in an LA suburb and appeared solidly middle class.

4.3 Data Analysis

I used a number of approaches in my effort to understand emerging patterns in my data set, and in this next section, I will expand on them.

Use of Grounded Theory techniques allowed me to find categories for analysis and to look for patterns related to gender and end-user programming (Straus & Corbin, 1990). Grounded Theory is based on the premise that nuanced understanding of behavior, such as the role of gender in domestic end-user programming can only be achieved by rigorous observation and analysis. It is a method that can be used for ethnographic analysis though it is not limited to ethnography, where an ethnographer iteratively reflects on that data set, then observes and builds upon hunches until patterns and categories of analysis emerge (Straus & Corbin, 1990). The open-coding process was followed by axial and then selective coding, which I will discuss shortly.

By employing Grounded Theory Techniques, an ethnographer creates or rejects hypotheses throughout the data collection process; emergent hypotheses influence the course of further study. Unlike formal hypothesis testing, it is not the explicit support or rejection of the hypothesis that is critical to understanding human behavior, but

rather it is the process by which the ethnographer arrived at, rejected, or modified a particular hypothesis.

I engaged in open coding to examine patterns in my data and to look at topics such as how various household security applications (firewalls, anti-virus programs) were used. I also looked for patterns in how role allocation, parenting practices, and how gender roles in the home were discussed.

After organizing this information into categories and sub-categories, patterns began to emerge. First, I was able to classify households into three categories based on their overall strategies for role allocation related to management of security tasks. I also looked at the range of strategies men and women used to manage their technical needs as well as their identities. Then, by looking at sub-categories such as household structure, activities by gender, technical ability and presentation of gender identity, etc. I was able to create axes along which sub-categories were linked, a central feature of axial coding. Next, I created a framework that illustrated the relationship between the two categories. The first category being strategies for household role allocation, which I will introduce in chapter 5 as Technology Czars Households, Self-Support Households, and Outside-Support Provider households. The second category being a masculine and feminine means of negotiating presentation of gender identity

which I will discuss in chapter 6 (for men adherence or deviation to a technical norm which I will call Digital Chivalry, and for women adoption a variety of strategies which I introduce as Geek, Damsel in Distress, Good Woman, and Technophobe). Finally, I engaged in selective coding to develop these sub-categories and to examine the relationships among them.

Doing so led me to arrive at a theory that we co-constructed our gender and technical identities around technologies. Use of Grounded Theory techniques also allowed me to deconstruct assumptions regarding gender and the role it plays within end-user programming of domestic technologies.

4.4 Summary

In choosing an ethnographic approach to study the importance of gender in households' end-user programming, I was able to look at the social, physical, fiscal and temporal environment in situ. My selection of homes in Silicon Valley and Santa Monica allowed me to include American households representing extremes (as much as was possible given the need to focus on Norton users or potential Norton users, all of whom would own computers) on a number of dimensions; further by studying elites who potentially have earlier access to consumer technologies due to their financial privilege, allows for

generalized insight about all potential technology users (Nadar, 1997). These dimensions included: overall level of domestic technology in the home; amount of masculine or feminine technologies; adherence to traditional gender roles; and a range of household structures. Using Grounded Theory techniques and allowed me to code and gain insight into the data I had gathered.

In the next chapter I will present these insights.

5 Technology Usage Patterns within Households

The study described in this chapter explores the research questions outlined in Chapter 1. Specifically, I examine men's and women's attitudes towards technology and the allocation of domestic programming tasks, and how the gendered nature of domestic appliances relates to programming. I attempt to fill in the gaps of knowledge regarding the relationship between domestic programming and gender. Specifically, work such as that of Strasser (1982), and Cowan (1983) examine housework, but this research precedes the inclusion of modern computing technologies into home-care rituals. Ethnographic research of authors such as Lally (2002) and Darrah, English-Lueck, and Freeman (2001) explores modern family life and the inclusion of technology; however, gender is not central to their arguments. I wish to bring together these trends of technology, gender, and domestic work, and I specifically look at the implications for use of technology. This leads to a discussion of what this means for the act of end-user programming as it relates to gender, and how this, in turn, impacts technology design.

In this chapter, I discuss my study of household members who were interviewed on the topic of how they kept their computers safe

and secure. I examine the structure of these households, the roles and responsibilities with in the household, and the types of activities done to assure safety and security.

While the human computer interaction (HCI) literature often distinguishes between security, a technical concern, and privacy, a largely social concern, in my work, similar to Dourish and et. al. (Dourish, Grinter, Delgado de la Flor, & Joseph, 2004), it became apparent during my interviews for my participants the boundary between "security" and "privacy" was indistinct.

Throughout the course of the interview, I asked open-ended questions about "privacy and security," and I found that participant responses belied their characterizations of what these issues entailed. Some focused on traditional security concerns: the security of the computer itself; software use to protect from viruses, spam, or spyware; use of firewalls; regular use of Windows or Macintosh system updates; individual application updates; defragmentation of the hard drive; other performance-related utilities; and back up of data.[1] Others I interviewed focused on what HCI literature typically calls privacy issues such as identity protection; use of multiple email accounts; credit-report, credit-card, and bank-account monitoring; and safe

online shopping practices. Others still stressed the importance of keeping children safe online. Interestingly, despite the open-ended formulation of my research questions, which enquired about *all* devices and practices used to secure the household, my respondents did not discuss security as it is manifested in physical forms (e.g. shredders, home security systems etc.). Given my employment with a software manufacturer, participants may have felt this type of security irrelevant and consciously omitted mention of it; regardless, its absence in the discussion was notable.

My interviews suggest that while technologists may differentiate between privacy and security, my interviewees did not. Consequently, throughout this chapter, I will use this set of tasks, which comprise the member's category of activities that keep them "safe and secure" and refer to this broadly as security.

Technical and social solutions to achieve privacy and security ranged from using blocking software, monitoring browser caches, and reading children's email, to keeping an eye on them through physical proximity. Each household and household member placed the emphasis on the relative importance of these tasks differently. The interview protocol encouraged participants to comment on each of

these areas, and it soon became clear that some areas were of particular concern while others were ignored.

Households had different approaches for allocating security roles and responsibilities. I observed three primary approaches to computer security in these homes. Here I classify households by the approach used to secure the knowledge needed to accomplish the most technically demanding of the security tasks, those which I earlier termed traditional security concerns, and three primary approaches emerged. The first involved households in which a single individual emerged as the Security Czar, or the go-to person for computer security problems; the second included households where individuals were self-sufficient; and the third focused on those who looked outside to an extended Technology Household or to an Outside-Support Provider to meet their needs. I will refer to these household types as Security Czar Households, Self-Support Households, and Outside-Support Households respectively. Additionally, there were households that were undergoing a period of transition between these categories often by combining multiple approaches.

In this work I use the term Security Czar as a subset of the Technology Czar responsibilities. The Technology Czar, as established

in my earlier work, was responsible for provision of the other household members' technology needs (Rode, Toye and Blackwell, 2005). I distinguish between Technology and Security Czar here because I collected information primarily on security technology as opposed to general household technology, such as programming the thermostat. I did collect one piece of data related to the Technology Czar, or who in the household programmed the VCR or DVR. In the majority of the cases this was the Security Czar, suggesting the Technology and Security Czar may be the same person. Both the Technology and Security Czar may reside in the home as a member of core household or simply be part of the extended Technology Household.

Next, I briefly discuss how these differences in household usage patterns cannot be explained merely in terms of household structure. Then I look at each of these three technology usage patterns to examine why the approach was used and to ascertain common characteristics among the households. I discuss the characteristics of the households that use each of these three ways of meeting their security needs--Security Czar Households, Self-Support Households, and Outside-Support Households--with a focus on technical skills and

attitudes towards and performance of gender-roles. I then discuss first the nature of the roles; second, who assumes them; and third, which aspects of security are of concern for households and household members. By discussing these three issues, I will explain how the technical abilities and professional backgrounds of the participants, gender, adherence to gender roles, structure of the household, and access to technical resources outside the home all affect the allocation of roles and responsibilities.

In presenting this data, I have three objectives. First, I will demonstrate that these approaches to obtaining security resources are contingent upon household structure, and that households can transition among these three major approaches in part because household structures in and of themselves are transitory. Secondly, I will show that the household's approach to security is based on centers of technical knowledge as well as household members' construction and perception of gender roles. Finally, I will introduce and support what will become a larger theme going forward—how gender and technical identity are co-constructed for both men and women.

5.1 Household Structure

Before proceeding with the discussion of the three general approaches I observed in my research, I discuss how they relate to household structure. In particular, I show that while these three types of households had diverse structures (see Figure 5-1), role allocation for technology use could not be explained merely in relation to household structure.

Figure 5-1. Household Structure

- 11 households with children under 18
  - 4 two-parent households with children
  - 4 female headed single-parent households
  - 3 male headed single-parent households, one of which had a roommate
- 9 households without children
  - 2 multi-generational households with adult children
  - 1 couple with a foster child who just moved out
  - 2 couples without children
  - 1 household of single male roommates
  - 3 single individuals living alone (2 female, 1 male)

I interviewed 20 households with individuals ranging in age from three to 85 with household structures that included single individuals, roommates, young couples, single parents, two-parent families with children, and elderly couples with grown children.

Within each of these structural types, I observed patterns in how they met their technology needs. [1]

Gender, not merely household structure, heavily influenced role allocation for technology use. In some cases, for example, patterns did emerge with regard to household structure; all three male-headed, single parent households had Security Czars, whereas all three of the female-headed, single-parent households, and the younger single woman both looked to a significant other outside the home and perhaps one other person for assistance. The final female head–of-household was undergoing a divorce, and as such she was transitioning from reliance on her husband to learning how to take care of things herself. Additionally, the two elderly couples both sought help from many different members of their friends and family.

In other types of households, fewer patterns emerged. Two of the two-parent families had a Security Czar; one split the duties between the two parents; and the other relied on their company's IT staff. One of the couples without children also relied on corporate IT, whereas the other had a Security Czar. The couple whose foster child

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[1] As part of my professional obligations to Symantec I interviewed the children in these households as well; however, my discussion here will be limited to the adult interviews as covered by my IRB.

had just left home and the two oldest of the singles (50s and 60s) all relied on themselves. While the resolution technological needs was based in part on a member's technical ability, household structure, and adherence to normative gender roles were also core to how households resolved their technological needs. This theme becomes apparent in my discussion of the three approaches households used to meet their security needs.

5.2 Security Czar Households

> *Frank (HH1) described safety and security as, "…nothing happens on it [the computer] that I didn't authorize… nothing comes off of it, nothing goes on to it."*

The first of the three approaches for households to meet their security needs were the Security Czar Households. Security Czars were responsible for traditional security tasks for the household's computers, computer-related childcare, and instruction in ways to protect household-member identity online. Security Czars were present in six of the 20 households I interviewed (see Figure 5-2 for a list of the members living in the household at the time of the interview, plus others mentioned as being part of the Technology

HH No.	Name	Role	Age	Living There (At Time of Interview)	Interviewed (Adults Only)	Occupation	Self Rating of PC Proficiency[1]
HH1	*Frank	Dad	48	Y	Y	Engineer	10
HH1	Kristin	Mom	45	Y	Y	Designer	6
HH1	Kyle	O. Son	15	Y	-	Student	-
HH1	Fiona	Daughter	12	Y	-	Student	-
HH1	Declan	Y. Son	9	Y	-	Student	-
HH9	*David	Dad	37	Y	Y	Computer Systems Architect	10
HH9	Taylor	Daughter	10	Y	-	Student	-
HH9	Joren	Son	5	Y	-	Student	-
HH9	Grandpa	Grandpa	83	N	-	-	-
HH12	*Eric	Dad	57	Y	Y	Broadcast Engineer	6
HH12	Katie	O. Daughter	16	Y	-	Student	-
HH12	Mia	Y. Daughter	12	Y	-	Student	-
HH12	David	Son	18	N	-	College Student (living away)	-
OC14	*Barbara	Mom	47	Y	Y	Writer/Publicist (was Designer)	6
OC14	Ken	Dad	51	Y	Y	General Contractor	4
OC14	Anna	Daughter	11	Y	-	Student	-
OC14	Owen	Son	7	Y	-	Student	-
SMO2	*Rajesh	Husband	36	Y	Y	Statistics Professor	7
SMO2	Debabrata	Rajesh's Father	70	Y	N	- (Visiting)	-
SMO2	Gita	Rajesh's Mother	60	Y	N	- (Visiting)	-
SMO2	Karabi	Wife	30	N	-	Professor	-
SMO5	*Lashawn	Dad	28	Y	Y	Service Specialist	9
SMO5	Shalyssa	Lashawn's Daughter	3	N	-	-	-
SMO5	Leslye	Roommate	24	Y	N	-	-

Figure 5-2. Households with Security Czars (shown with *).

Household). By definition, a Security Czar can only be present in multi-user households; a single user who relies on himself or herself alone is by definition independent, and thus a self-sufficient household. The

Security-Czar Households consisted of two nuclear families, two single fathers with full-time custody of their children, and one single father[2] with partial custody of his child and a new platonic roommate. I have also included a professor who resides in a different state from his wife.[3] These Security-Czar Households had a number of characteristics in common with regard to the Security Czars' levels of technical sophistication and tasks they performed.

5.2.1 Characteristics of Security-Czar Households

The role of Security Czars tended to be held by the most technically sophisticated member of the household; the Security Czars were highly technical in terms of professional background, rating of their own technical ability, and in the type of security tasks they performed. The Security Czar in five of these six instances was male. The Security Czars' jobs included several engineers, a statistics professor who relied heavily on computer modeling software, and a

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[2] As part of a pre-test questionnaire, individuals were asked: On the following 10-point scale, circle the number that best represents your computer proficiency, where 1 means a "novice user with virtually no experience with a computer" and 10 means "technical professional expert"?

[3] She is also a professor, and she and her husband both hope to find jobs in the same city.

"service specialist" who provided technical support over the phone. Each of these jobs typically required significant computer skills. Barbara (OC14), the single Security Czarina, was exceptional in her computer use. In her profession as a writer and publicist, she made heavy use of the computer; after having children, however, she found the design trade had gone to CAD, which she did not wish to learn, so she had actually chosen to switch professions. In instances where my research team and I interviewed multiple adults in the household, the Security Czars ranked themselves higher than their partners' self-rating. On a self-assessment of technical, a scale of 1-10 with ten being the most-sophisticated, Security Czar's self-ratings (10, 10, 6, 6, 7, 9) were typically above the mean rating of 6.76 (Standard Deviation 2.21), with the exception of Barbara (OC14) and Eric (HH12) who each rated themselves a six. Additionally, there were similarities in the types of activities performed by the Security Czars. This high level of technical ability is of interest relative to the abilities of others in these household, or when compared to Outside-Support Households.

5.2.2 Activities of Security Czar Households

The Security Czar engaged in support for multiple computers in the household. Each of the four Security-Czar households that contained at least one PC regularly used a specific virus-protection application, had up-to-date virus definitions, and used either a hardware or software firewall, and for security, the fifth (Baja-OC14), an all Macintosh household, subscribed to and relied on .Mac, which includes virus protection.[4] The Security Czars with PCs each used anti-spyware software (it is commonly believed that anti-spyware is less necessary on Macintoshes), and most of these households engaged in regular back-up practices.[5] In this fashion, Security Czars were responsible for the security maintenance of the computers in their households.

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[4] Barbara (OC14) described firewalls by saying, "a company has to have [one] to protect client's data" which is broadly correct though it may suggest she is not aware of how firewalls function. She correctly said regarding security "Apple has stuff built in." Apple's wireless network does have a firewall built-in, so she was protected. The male Security Czars were able to describe why a firewall in the home was needed in addition to being able to set one up.

[5] The exception was the Taraval Household (HH12), which consisted of a father with two teenaged daughters who only used his computer for work email. He had a back-up application for which he felt no need given that his work email was backed up.

However, other adults and older children in the Security-Czar Households actively engaged in other security activities, which included safe banking and shopping practices along with identity-theft protection procedures. In some of these households, it became apparent through interviews with the household members and the Security Czars themselves that the Security Czar was instrumental in educating them. This opens the possibility that as parties in households increase their skill levels, the holder of the Security Czar role, and more broadly how the household organizes itself to meet its technology needs, may change.

As a result, perhaps, household Security Czars focused on controlling the computer environment for everyone. For instance, Frank (HH1) described safety and security as, "…nothing happens on it [the computer] that I didn't authorize… nothing comes off of it, nothing goes on to it." Similarly, Lashawn (HHSMO5) maintained a home network for his daughter and himself, a network which was also used by his new roommate[6] and upstairs neighbor. When asked if he obtains any technological advice from his colleagues at work, he stressed his self-reliance and his own expertise saying, "No. I set this

[6] The roommate had moved in very recently so her computing habits relative to the household had not yet been established.

stuff up for *other* people… pretty straightforward." He goes to great lengths to keep his computer safe, including having a separate computer for trying out risky software. He also uses anti-virus, several different anti-spyware programs, firewalls, VPN; regularly updates Windows; engages in a monthly back-up routine; defragments the hard drive; reboots regularly; and physically dusts the machine. He limits spam by using anti-spam software, multiple email accounts, and best practices to limit junk mail. He complains that others do not practice similar safe computing practices and says, "I hate that…. some people do not know enough." While he asserts that computing, like driving a car, requires personal responsibility and training, he prefers to use "access controls" to keep his friends from "messing up" his computers. He has a primary personal machine, and he maintains a separate computer for use by his daughter and his friends. Frank and Lashawn were both successfully maintaining control of their households' technology. Control via technological mastery provided Frank and Lashawn with a way to affirm their masculinity. In other households, control presented a challenge as social negotiation was required to maintain it.

Eric (HH12) had a technologically sophisticated son who had just left for college and was actively trying to maintain himself as Security Czar. Eric was careful to stress than while his son, David, may set up technologies such as multiple user accounts or the wireless, Eric was the one in charge of the security in the home. So when David set up the household network, Eric insisted that the network be set up with a password for security. Recently, however, Eric's friend Veronica began spending increasing amounts of time at his home, and he wanted to give her access to the network. Eric was embarrassed in that he needed to call his son to get the password. Here, even though Eric holds the role of Security Czar, he must continue to negotiate to continue to hold this dominant role as skill levels in the household change.

Barbara was our one Security Czarina, and she, too, spoke of her computer maintenance activities in terms of control by stressing that she was "vigilant." However, she also discussed these activities in terms of their relationship to housework. I interviewed her together with her husband Ken, a general contractor. Barbara was responsible for the IT in the house. Reluctant to be interviewed alone because he didn't think he knew enough technically to be worthy of the interview

time, Ken insisted on being interviewed with his wife. Ken's insecurity about his technical ability was unique among the men. He presented himself both as not technical and less technical than he should be--deviating from a norm. While several of my women interviewees unabashedly presented themselves as not technical, none implied they were less technical than they should be. Therefore, I suspected that Ken's true motivation was concern that I would judge him negatively in view of his limited technical skills.

Throughout the interview, both parties volunteered information as to why Barbara was in charge of the technology. Her husband emphasized that her superior technical ability resulted from his being "too impatient." Barbara stressed his technical ability in other realms, "he's the building guy, and he can build a house." Barbara's comment could be interpreted as justification for her household's division of labor, which simultaneously reinforced her femininity and her husband's masculinity. She used to hire an external contractor (which placed her in the Outside-Support Household category), but over time, she has become increasingly confident and rarely seeks assistance from her outside contractor. When Ken and Barbara moved to their

new house, Barbara set up the network herself, which she said to demonstrate her independence from the outside contractor.

A private conversation with Barbara after the dinner interview served to illuminate the division of responsibilities in this home. I offered to help Barbara clean up, which built rapport and prompted her to comment that it was unusual to get help with the housework. While her reaction was no doubt related to a gender division of labor, she chose to reinforce her own feminine role. This suggests that her husband's refusal to help with the housework is an example of his taking steps to reinforce the presentation of his masculinity. While cleaning up, Barbara and I continued our discussion about her active role taking care of the computers:

> Barbara: "It became clear he was not going to do it" and then almost defensively—"he did not have the time."
>
> Jen: "Like taking care of the house?" (Said jokingly in reference to his not helping, as we were washing dishes and he was upstairs).
>
> Barbara: "Yeah, it is just another type of housework… "

For Barbara, cleaning the viruses from the computer was an extension of her role as a working mom who was accustomed to organizing her free-lance consulting work around her parental and household responsibilities. Just as we saw in Strasser (1985), this is yet another

example of how modern technology is integrated into a woman's domestic role.

While Barbara and her husband felt the need to explain why it was Barbara who was in charge of the technology, neither Kristin nor Frank, the heads of the other two-adult household, made such comments. Here, Frank was the Security Czar, but despite our asking, neither member of this household volunteered any rationale for how roles were assigned beyond it being "Frank's job," nor commented on the differences in their technological abilities. This suggests that to them the role division was typical enough to not require comment. In these and other households, the Security Czar the most motivated and technically sophisticated individual, and more often than not, the Security Czar was male.

Despite this gendered difference in approach, control of their household's computing environment was important to all of our Security Czars. A key challenge for all families with children was keeping them safe online, and our five Security-Czar Households with children were similarly concerned. While Security Czars Households also employed social solutions such as proximity and an open-door policy to keep their kids safe online, Security-Czar Households were

more likely to use, or had plans to use, at least some sort of monitoring technology at the Security Czar's instigation. Examples included setting up emails to be cc'd to the parent, reading web-logs, or setting up multiple accounts so that the adult could access the child's account.

While two households did not use monitoring technologies at the time of the study, they expected to do so at some point. David (HH9), recently divorced, explicitly stated that he had "not gotten around to it," though he had discussed it with his former wife. Whereas Lashawn (SMO5) stated that while he was currently able to physically watch over his three-year-old daughter's shoulder when she was at the computer, he had not yet decided how he would handle the situation when she gets older.

Eric (HH12), Frank (HH1), and Barbara (OC14) all were currently relying on monitoring technology, which I will describe in depth next. Eric (HH12) had told his two teenaged daughters that they were not supposed to password-protect the account.[7] During the course of the interview, when it became apparent that his eldest daughter had

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[7] The Martins (HH1) used a similar strategy when their foster daughter was still living with them. Javed was acting as the foster daughter's Security Czar, while Kate's usage remained independent.

disregarded this rule, Eric demanded that she, "take it [the password] off or tell us." Given that our interview took place within earshot of his daughters, David was reluctant to explain why he wanted access to his daughters' accounts. Earlier, however, he had commented that one has to assume that people have access to email just as postal workers have access to the content of postcards. This suggests that his insistence on open accounts was based on his perception that his daughters' computer use needed to be monitored as well as administratively maintained. Frank also engaged in extensive monitoring of his three children ages 9, 12, and 15. He had set up a very protective computing environment for all of the children, in part because the eldest was developmentally disabled. When asked to describe his feelings about his children's safety online he responded,

> "you must understand...I run their mail server... and I run their web proxy server.. and I read the logs.. and every email that comes to them comes to me too... now you know, they know this... and uh, but I don't necessarily remind them, I like them to feel independent... and safe... but I am, I try to be quite vigilant…"

He added that he tries to "appear omnipotent, and until they get a little bit older that will work." Therefore, he had not only set up the household computing system to allow him to monitor all websites his children visited, the system allowed him to read all of their email.

This type of oversight has potential for violating the privacy of other household members. For instance, at one point my co-interviewer asked to see the anti-virus software on one of the computers on the house. Frank's daughter had left a file open, causing Frank to comment as he reads from his child's open diary, "let's see… dear diary… probably shouldn't be reading that one." Later, when examining a different computer a number of web pages were open, and Frank jokes for the benefit of my tape recording "for those of you at home…when we came in kids were doing homework…bunch of web pages open…not trivial ones." Frank is entrusted not just with the care of the computer, but to not adversely affect works in progress.

Being a Security Czar means encountering open files—in this household that meant web pages needed for schoolwork or diaries, which children do not want their parents to read. In other households, the Security Czar may be a teenager performing the computer maintenance for adults, thereby encountering their parents' confidential documents—taxes, medical records, bank statement to which parents might not want their teen to have access. Being a teen-age Security Czar, as illustrated in my Domestic Economy work (as discussed in chapter 2), may not carry the same authority as an adult

in the role; the technical knowledge, however, constitutes power which can be used to confront authority. In either case, the Security Czar position appears to allow access to data which the household members may wish to retain as private and confidential.

Like Frank, Barbara of the Baja Household (OC14) was also engaged in monitoring; in addition, she relied on her daughter's feedback. On one occasion, the daughter reported that the family's teenaged babysitter ignored the kids and played on the computer. Through some research, Barbara learned that the babysitter was putting suggestive pictures of herself on MySpace, which prompted Barbara to call the babysitter's mother to explain the potential risk. On another occasion, her son Owen brought a friend over to play. While Owen at age seven is not sexually curious, his friend of about the same age comes from a more permissive household. His friend used the computer to browse for images of "sexie school gurls." Mom caught this by browsing the cache. She never expected that from her son, but she told him firmly not to let his friend browse for those kinds of images or he would never be allowed to use the computer again.

The effects of monitoring go beyond the boundaries of the household to children and adults outside the home. In Barbara's case,

she watched out for children using her computer. In Lashawn's case, (HHSMO5) he not only maintained a computer for people visiting his home, he also assisted individuals outside his home. Lashawn claims to assist about 15 people, a mixture of "people for business," friends, family, students, and "older people." His role as Security Czar extends to his community at large, and he phrases it in terms of keeping control of those around him. Lashawn is the Security Czar of his home, but he is also the Outside-Support Provider for several other Outside-Support Households. This observation underscores the importance of moving beyond the core household membership to the entire Technology Household as the unit of analysis for understanding how technology needs are met.

Security Czars then serve as the centers of technical knowledge in their homes. Further, these roles serve as a locus of power and authority as these are negotiated in response to–and because of–technology. Technologies change, and people respond to these changes by learning new skills. At the same time, household boundaries change, and as such, the role of Security Czar must be negotiated and maintained.

5.3 Self-Support Households

> *Kathy (HH7) described her strategy for sharing security work with her husband, saying that at work, she is "highly technical" [whereas] at home, "he does it faster." Makes a great comment about dangling a carrot, and he will just fix things, but you need to be careful when you dangle– "it's like a drug." (Fieldnotes HV-IV-7-Kathy)*

The second of the three ways in which households met their security needs involved computer owners in each household supporting their own computers. This category, which I refer to as Self-Support Households, consisted of single individuals who supported themselves and households with at least two or more adults who needed to coordinate their activities. The nature of this category means that single parents who support their own children could not be included. In these homes, the distribution of power in terms of knowledge derived from technical training, hobbies, or careers, and the resulting authority was more balanced between the adult partners.

5.3.1 Characteristics of Self-Support Households

The Self-Support Households consisted of two single-user households and two mixed-sex households with children. Like Security Czar Households, the Self-Support Households had significant technical ability; however, mixed-sex Self-Support Households differed from

Security-Czar Households in terms of evenly distributed technical ability among household members. For instance, Javed and Kate (HH2) both ranked their computing proficiency highly. Javed worked as a software engineer, and Kate, while she was not working in a technical profession, had obtained a master's degree in software engineering prior to deciding to train as an EMT. Similarly, both Kathy and Tom (HH7) worked at software companies and rated their computing skills highly. The single individuals, while neither had technologically demanding careers, both came across as more confident with regard to technology during the interview and were older than the singles in Outside-Support Households.

HH No.	Name	Role	Age	Living There (At Time of Interview)	Interviewed (Adults Only)	Occupation	Self Rating of PC Proficiency
HH2	Javed	Husband	40	Y	Y	Software Engineer	9
HH2	Kate	Wife	36	Y	Y	EMT Student	9
HH2	Mia	Foster Daughter	18	N	-	Student	-
HH7	Kathy	Mom	45	Y	Y	Product Researcher	8
HH7	Tom	Dad	41	Y	Y	Software Consultant	10
HH7	Michael	Older Son	12	Y	-	Student	-
HH7	David	Younger Son	9	Y	-	Student	-
SMO1	Miranda	"Queen of Household"	50	Y	Y	Unemployed- Recent Library Analyst PhD	5
SMO3	John	Head of Household	60	Y	Y	Lawyer	9

Figure 5-3. Self-Support Households

5.3.2 Activities of Self-Sufficient Households

While the allocation of security roles and responsibilities differed sharply between Security-Czar Households and Self-Support Households, the security activities performed were broadly similar with four exceptions. First, variation in security practices by platform was more readily observed in Self-Support Households, perhaps only because there were more Macintosh users in this category. Second, Self-Support Households, unlike Security-Czar Households, had coordination and negotiation difficulties among the adults performing

security tasks. Third, whereas in Security-Czar Households only the household with the Security Czarina choose to comment on the domestic division of labor and how both she and her husband presented her gender and technical ability, several of the women in the Self-Support Households spoke at length about these issues Fourth, and perhaps as a consequence, I observed the women in Self-Support Households providing the computer-security-related childcare, whereas in Security Czar Households, the Security Czar, regardless of gender, provided such care. Next, I will discuss in greater depth how each of these activities differed.

All three households with Windows PCs had routinely used security software and firewalls, and additionally, the West (HH7) and Martin (HH2) households both used anti-spyware applications. John, of the Robin Hill household (SMO3), engages in routine back-up practices, and uses Norton Systems Works to ensure optimal machine performance.

The Self-Support Households with Macintosh users (HH1, SMO1) both asserted that having a Macintosh required less computer security than the PC. The Martins (HH2) argued, "it's a Mac—it's safe," and Miranda in the Ogden household (SMO1) explained that having a

Macintosh allows her to be "in the vast minority," so that the people who want to cause "mayhem" do not get to feel as much satisfaction as they do by developing viruses for PCs, which account for over 90 percent of the market. Generally, Windows and Macintosh users in the Self-Support Households engaged in activities of similar rigor to the Security Czar Households.

Regardless of platform, most of these users had home networks. (The exception was Miranda (SMO1) who did not see the point of networking her laptop as it would only distract her while writing her dissertation. Instead, she wrote on her distraction-free laptop, and maintained a separate desktop where she could surf and check email). Unlike Security Czar households, the networks were presented as ad-hoc with no one individual in control of their organization. It is unclear whether this was how the networks were in practice setup, or whether it was merely an ideal which guided the organization of home life[8]. However, these interviews, to the extent they addressed the topic, suggested a cooperative spirit.

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[8] A follow-up study was planned to further investigate issues surrounding home networking in particular. These issues were addressed in more detail in that interview script. Unfortunately, this research was canceled due to budgetary constraints at Symantec which resulted in an unexpected gap in the research regarding home networks.

One significant difference from the Security-Czar Households was that in the two-adult households, coordination difficulties ensued. In the Martin household (HH2), for example, Kate was going to buy a new computer since her current machine was too slow. After learning that it was slow due to spyware, she discovered that while McAfee had been installed on multiple machines, the household had purchased only one license, and Kate and her husband each claimed ownership of it. Similarly, the West household (HH7) demonstrated a discrepancy in security practices. Kathy had a firewall on her laptop, and Tom did not. Tom used an anti-spyware program, whereas Kathy did not.[9] Multiple individuals in charge of security leave open the possibility that things requiring coordination across machines, such as software licensing and transfer of knowledge, may not occur.

Not only were there differences in how couples practiced and coordinated care, there were differences in how the women in these two households discussed their involvement in home computing security. Kate (HH2) did not volunteer comments about her technical abilities and only mentioned her husband's technology in the context

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[9] In both households, the husband assumed responsibility for the online banking as is typical of high-income families (Webley, 2001). As a former usability provider at her bank, Kathy did not trust the bank's security and wanted her husband to ensure their safety.

of coordinating software licensing and care for their foster daughter. She felt her technical abilities and the allocation of the couple's roles were unremarkable.[10]

Kathy (HH7), who is a product researcher in a technology company, however, spent considerable time explaining her technical identity. She describes herself as,

> "textbook [in that] she can do it all at the office but does not know how to use the speakers. [She stated,] "I don't want to have to do tech." She wants to turn her brain off when she gets home and just ask her husband, even though she could have figured it out at work. [She] jokes, "it's his job, I do the dishes." (Fieldnotes HV-IV-7-Kathy)

Though Kathy claims she "turns off her brain" with regard to technology at home, she competently described needing to remind her ISP to turn "SMTP authentication" back on when her email account gets hijacked. She describes her security practices as follows,

> She says she is "pretty vigilant" and has two main strategies to keep herself safe online: "no static IP and get virus software up [and running]… it's the only safeguard you've got so they won't target a specific machine." She uses IP mirroring from DSL to house – this is set up by some combination of her husband and her provider. She said to ask him [her husband] for more details, "He's the IT guy."
>
> At work she says she is "highly technical" [whereas] here "he does it faster." Makes a great comment about dangling a carrot,

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[10] Marjorie (SMO4) likewise did not comment on her own technical abilities, aside from saying she knew "enough info not to do stupid things."

> and he will just fix things, but you need to be careful when you dangle– "it's like a drug." (Fieldnotes HV-IV-7-Kathy)

Kathy is independent, but by strategically "dangling a carrot" in front of her husband, she takes advantage of what she perceives to be his ability to do things faster and to perform tasks she does not wish to do. Kathy gives an example of a recent installation,

> [She] said when she installed something [unspecified] she handed it to Tom to poke at—he played with it for a day and figured it out. (Fieldnotes HV-IV-7-Kathy)

Kathy is capable of maintaining her own machine and does a great deal of the maintenance; however, she is constructing her technical ability in response to her situation and occasionally appeals to traditional gender roles--"it's his job, I do the dishes." When Kathy mentioned, "dangling a carrot," she said it almost suggestively, giving me a knowing look that implied I knew exactly what she meant. Of course, from the rest of her comments, we know that the technical problem itself serves as a "carrot" in that her partner relishes the chance to master technology. What went unspoken and was conveyed only by Kathy's tone is that flirtation, flattery, and appeals to gender roles, all can be combined to encourage him to do the task.

Even though both of these women were engaged in the security activities in the home, they were negotiating their activities with

regard to their presentation of their feminine identity very differently. Kathy acknowledged that there were differences between her technical ability and that of her husband; additionally she knew her husband's fascination with technology was a strong motivator for him. She would take advantage of these ability differences and appeal to gender roles to ensure completion of tasks. In Kate's case, however, while gender roles existed in the form of her more extensive involvement in computer related childcare, these roles were not explicitly appealed to in determining how tasks were allocated. This suggests construction of technical and feminine identities can vary substantially even in households with similar technology role allocation.

In both of these households, care for the children's safety online was a topic the women spoke to at much greater length, even though both men were asked the same questions which is indicative of these women's greater involvement in childcare related to computer use. Neither household used monitoring software. Kate, in the Martin household, (HH2) chose to let her 17-year-old foster daughter "have her own outlet," akin to boyd's arguments that web is playing an important role in teens identity formation (2006). Her husband clarified that he and his wife did let Mai browse adult content and

download images. He explained, "She's basically grown up enough to do her own thing…. no concern about porn sites." While the Martins did not place limits on what their foster daughter did online, they chose to protect the computer with anti-spyware software and by giving her a user account without administrator privileges which restricted her ability to download and install software while browsing adult-content online. [11] Kate discussed safe online behavior with her foster daughter and made final purchases of items her daughter selected when browsing online. Kate assumed more responsibility than her husband for her foster daughter's online actions and primarily used social means augmented by infrastructure to ensure her safety.

Similarly, in the West household (HH7), Kathy uses social rather than technical means to keep her children safe online. She limits their total amount of screen time and insists on being physically present when they are online. She has deliberately chosen not to place the children's computer in the playroom on the network. This means the children can only use the Internet when in the kitchen or office, which makes parental supervision much easier. Depending on what her children are doing, Kathy might pay more or less attention; videos on

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[11] Adult content is notoriously full of viruses and spyware.

YouTube, for example, increase the possibility that children will view adult content. While Kathy and her husband were both responsible for their own computers, it was Kathy who managed the children's safety online.

Whereas Security Czars, the five male and one female alike, were primarily responsible for monitoring children's activities online, women in the Self-Support Households were fully responsible for the day-to-day, computer-related childcare tasks. While the adults were each responsible for themselves, the women were, in essence, acting as Security Czars for the children by assuming primary responsibility for child-care related computing. Instead of monitoring technologies, these households relied on social means augmented by infrastructure to limit access (not putting computer on a network, or not allowing software installation).

The Security-Czar Households and Self-Support Households had many similarities in terms of security activities, yet there were some key gender differences from the primarily male Security Czars. Women in this category had greater technical ability than the female recipients of Security-Czar care. I saw examples of both men and women supporting themselves in Self-Support Households, and within the

two-adult Self-Support Households, women were technologically independent. However, unlike the women in Security-Czar Households, women in Self-Support Households had the additional burdens of communication difficulties and meeting their own and their children's technology needs. When asked about their roles in using the various security technologies and the history of each security technology in the home, these women used a range of approaches in discussing their technical and gender identities. For some women it became clear that their technical and gender identities were subject to much explicit negotiation whereas others answered without mentioning their technical and gender identities. Yet their involvement and decision to participate or not participate in these security tasks means that all of these women were co-constructing their gender and technological identities. While it is possible that additional interviews and increased rapport might have brought about further comment, I believe that for these women, the division of labor related to technology in their homes was unremarkable. Such technically trained women had been socialized in such a way that their abilities were not at odds with their femininity. Given that the men in these households chose to marry women with comparable technical skills also suggests that women

who possess significant technical abilities pose no threat to their spouse's masculinity. In the next chapter, I continue the discussion of how and why attitudes toward Gender Identity and Technical Ability contribute to the performance of technical work in the home. Before returning to the topic, however, we need to look at Outside-Support households.

5.4 Outside-Support Households

> *Um, I don't know what there is so, I rely on my IT person at the office to recommend what we need, and he has just put the Trend (Microsystems Anti Virus) on it. But uh, one of my solutions, but nobody one will listen to me…" (Christina HH3).*

The third and final way in which households met their security needs was to seek help from a source outside the household boundaries. This Outside-Support Provider became part of the households' larger Technology Household, and the individuals providing the support may well have been Security Czars or self-sufficient individuals in their own homes. These six Outside-Support Households sought external assistance from corporate IT, friends and family, or some combination of the two. Outside-Support Households differed from Security-Czar Households and Self-Support Households

both in terms of demographic characteristics and the activities performed.

5.4.1 Characteristics of Outside-Support Households

All of the Outside-Support Households were less technical than those in the other two categories, but among Outside-Support Households. This relative technical disparity was likely a key contributor to their need to seek outside sources of current and more advanced technical knowledge. However, there were additional demographic differences. In particular, there was a distinct demographic difference based on the source for their Outside-Support Provider. The mixed-sex households, the Vicksburg and Oak households (HH3 & 5), both relied on their company's IT department whereas the single women primarily sought help from significant others.

In the households with Outside-Support Providers from corporate IT, the computers were typically company owned. The company supported the computer and provided all networking save needing a local ISP. In the case of the Vicksburg household (HH3) this was a matter of choice, as to how Christina structured her role as

office manager. In the case of the Oak household (HH5) some of this may have been due to corporate policies for maintenance of work machines, but it became clear from the interview that their use of the work machine included personal computing which violated corporate policies. While Rati had a Macintosh owned by the household which only she used for Macintosh specific media activities, they were choosing to rely on their company for there personal computing uses. Rati explained this was largely due to the convenience of not having to use two computers. The Vicksburg household owned two computers, both of which belonged to the small business that she and her husband managed or owned. Christina was an office manager. Bob uses one computer, and Christina and the children use another. Both computers were maintained by IT. Her husband was not available to be interviewed. However, from her interview, it appeared he delegated his computer support duties to Christina in her professional role as office manager. Given she lacks the IT skills required to be a Security Czarina, she in turn relied on IT. This is a similar situation to Barbara in the Baja Household (OC14) before she learned how to do the security work herself. This suggests that the Vicksburg husband and wife and the couple in the Baja household manage their gender

identities in similar ways. The young married couple in the Oak household also used their work-provided laptops for business and pleasure and relied on corporate IT to maintain them. Corporate IT computer ownership was a primary differentiator from households supported by friends or family.

The other households' Outside-Support Provider included a significant other in combination with other people (this included HH6, 10 & SMO4). These households all consisted of women living without other adults. Unlike the other Outside-Support Households that used IT as the Outside-Support Provider and worked at companies with significant IT support, these women worked in careers (marketing, film production, biotech management) that were less computer-focused and thereby characterized by less access to professional IT support. These individuals owned single computers and did not have a home network.

HH No.	Name	Role	Age	Living There (At Time of Interview)	Interviewed (Adults Only)	Occupation	Self Rating of PC Proficiency
HH3	Christine	Mom	49	Y	Y	Office Manager	5
HH3	Bob	Dad	49	Y	N	-	-
HH3	Sophia	Daughter	10	Y	-	-	-
HH3	Christopher	Son	8	Y	-	-	-
HH3	Corp IT	*IT Provider	-	NA	-	-	-
HH5	Rati	Wife	32	Y	Y	Sr. User Researcher	7
HH5	Sameer	Husband	32	Y	Y	Sr. Demand Planning Analyst	9
HH5	Corp IT	*IT Provider	-	NA	-	-	-
HH6	Yan	Mom	40	Y	Y	Biotech Alliance Manager	8
HH6	Jennifer	O. Daughter	12	Y	-	-	-
HH6	Allison	Y. Daughter	7	Y	-	-	-
HH6	-	*Boyfriend	-	N	-	-	-
HH10	Lori	Mom	42	Y	Y	Software Marketing	6
HH10	Noah	Dad	6	Y	-	-	-
HH10	-	*Husband/ Separated	-	N	-	-	-
HH11	Lisa	Mom	39	Y	Y	Mental Health Provider	7
HH11	TJ	Son	6	Y	-	-	-
HH11	-	*Boyfriend/ Corp IT Colleague	-	N	-	-	-
SMO4	Sara	Head of Household	32	Y	Y	Production Coordinator (Film)	8
SMO4	-	*Boyfriend	-	N	-	-	-
SMO4	-	*Brother	-	N	-	-	-

Figure 5-4. Outside-Support Households. (Figure contains both core household members as well as the extended Technology Household on which they rely. Outside-Support Provider is shown with *.).

Finally, Lisa of the Lagunitas household (HH11), combined these two approaches because she was dating a man in her company's IT department. Due to her romantic relationship, she received individualized technical services beyond what she could expect him to provide in his official capacity as company IT.

Outside-Support Households negotiated assistance through existing social relationships. Professional relationships allowed some

households to obtain both computers and support out of professional obligation, whereas social relationships allowed gifts of technological expertise and equipment. The source of the Outside-Support Provider and resulting obligation affected how household members went about getting help, which I will discuss in the next section.

5.4.2 Activities of Outside-Support Households.

All of these households relied on help outside the home for their most technically demanding security tasks. However, there were also activities for which they relied on other members of the household or took care of by themselves.

One area in which all of these households relied on their Outside-Support Provider was computer selection and setup of initial security software. These households owned a total of 11 computers, nine of which were selected by friends or corporate IT.[12] Two of the Oak household computers, the Vicksburg computers (HH3) and the Lakeshore computer (HH10), were owned by their offices and selected by IT personnel who configured the machines with security software.

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[12] How the remaining two computers were selected was not specified during the interview due to the open-ended nature of the questions (HH5 & 11).

The other three were single women whose boyfriends selected (HH11, SMO4) or friend[13] helped (HH6) with the computer selection and setup of a secure computing environment.

For individuals who used their social networks to obtain their Outside-Support Provider, this assistance represented a gift. As Sara of the Hayworth household (SMO4) explains, "part of the gift was that someone set it all up for me." Lisa stressed that because it was a gift she was not able to influence decisions. Her boyfriend installed AVG, a popular Anti-Virus program, because it was free and would not require an annual payment to update. Yet once she started using it, she found she preferred the interface of Norton anti-virus, which she had on her old computer. She wanted to switch back, but did not know how. Since it was a gift she had to wait for an appropriate time to ask him for additional help and socially negotiate the situation so as not to appear ungrateful.

In addition to computer selection and the initial security setup, individuals who used their social networks to obtain their Outside-Support Provider sought help with major issues. For instance, Christina of the Vicksburg home (HH3) went to her IT department to remove a

[13] He was described as a friend, but this sounded as if it may have been a euphemism for a more intimate relationship.

virus whereas Sara, of the Hayworth household (SMO4), sought help from her brother and then from her now ex-boyfriend to recover data following a hard-drive failure. Lori of the Lakeshore home (HH10) and Yan of Montelena (HH6) both went to their outside resources to have their home networks installed. In some instances, the Outside-Support Provider set up the computer to automatically update itself with current virus definitions and other security updates (HH3, Sameer in HH5, HH6, HH11). Despite this reliance on external resources, there were areas where these individuals were self-reliant.

There were three key areas where these households relied on themselves. First, these households were self-reliant when they were unable to obtain additional assistance and were forced to fill in the gaps to make the technology usable. For instance, given that home networks are not something corporate IT at larger firms will typically set up for employees, the Oak (HH5) home network was set-up by Sameer.[14] While in some instances the Outside-Support Providers set up computers to automatically update in some households (Rati in HH5, HH10, SMO4), the core members themselves were responsible for routine security maintenance such as installing Windows updates or

[14] Rati of the Oak households (HH5) goes to a male IT-friend for assistance when she encounters a problem.

updating virus definition files for their own computers. Second, these individuals were very concerned about identity theft, spam, and safe shopping practices, and engaged in a number of protective practices. These included not giving out contact information; using different email addresses or fake email addresses for potentially risky situations; avoiding online shopping; regularly monitoring credit-card statements; looking for security icons; and avoiding unknown sites. Finally, the third area of independence focused on keeping children safe online. For instance, Yan, a Chinese-American divorcee (HH6) with two young daughters, sought out and installed Net Nanny herself after learning her daughter had been approached by a stranger online and had had a bad experience. Similarly, Lisa's (HH11) motivation to ask her boyfriend to help set up a new machine was based on her concern that her son would damage her files accidentally. Once she obtained a second monitor, she planned on giving her son his own computer, but in the interim she has multiple accounts so that she can log him in separately. Lisa and Christina (HH3) also engage in in-room monitoring strategies of the children's activities. Having outside security support still left these individuals with tasks they needed to perform themselves.

Yet, despite this independence from outside support for some security activities, some of the women in this category attempted to minimize their technical abilities by either downplaying the abilities themselves or their abilities relative to their Outside-Support Provider.

Two of these women downplayed their technical knowledge directly. Rati, a usability professional (HH5) at a major software company, downplayed her understanding of home networks, an area for which her husband was responsible. During the course of the interview, she was asked how she would describe a firewall to a friend. She explained, "kind of like your wireless encryption… you set it up to protect your Internet connection and keep people from hacking in." This is a largely technically correct definition, yet she preceded the remark by saying, "that's his department…" (laughing and pointing at her husband being interviewed in the next room). She clarified that she would not know how to configure it, again implying that it was his domain. Similarly, Yan, of the Montelena household (HH6), who holds a Ph.D. and a professional position in a biotech firm, easily and accurately explained that some viruses "delete (files) or severely damage your computer" adding that they "can spread out—automatically affect others—[via a] mailing list." Despite being

correct, she prefaced her answer with the caveat that she was "not savvy" when it came to technology. By downplaying their technical abilities or playing up the abilities of others Rati and Yan are both minimizing their expertise, and presenting themselves as a non-expert.

Another strategy employed by two women in Outside-Support Households was to explain technological behavior in metaphorical terms by drawing on non-computing domains. Whereas, men often discuss technology in terms of specific technical functionalities or a set of acceptable technical metaphors that allow them to express mastery and control, these women did not (Livingston, 1992). While this might not follow the dominant masculine discourse, this approach served adequately for these women's needs. Sara (SMO4), for example, described anti-spyware software as something that "protects her from evil things." A more involved series of vignettes from Christina of the Vicksburg home (HH3) speaks to the same point.

Christina willingly gave control of her laptop to the IT person, and trusted his judgment as to when to update software saying she would "rely on IT people to tell" her what she needed. For instance, when discussing how the IT person repaired her computer after a virus

caused it to start running slowly, she mentioned he did his "magic." Further, she expressed hesitation about shopping on Amazon.com, joking that when she did find herself needing to shop there, she would "pray" that everything would work out well. She returned to this later when I asked her how she determined which sites were safe, saying that she relied on "just prayer"; beyond prayer, she said she "did not know how to decide." Christina's needs were served by explaining these technologies in metaphorical terms that pull from other domains. While the activity of prayer itself might be viewed as a means of expressing control, Christina's comment, "I did not know how to decide," conveys uncertainty. Unfortunately, this gendered difference in terminology—terms of technological mastery compared to use of non-accepted metaphors—has the potential of being misinterpreted. Christina's uncertainty has the potential of coloring her metaphorical usage making it appear unsophisticated, as opposed to employing a different paradigm.

For instance, Christina demonstrated significant technological knowledge in her understanding of viruses, yet her husband disregarded her technological solution to the virus problem. During the interview she was asked to define a virus, which she described as "a

worm eating away at the computer brains." She reported using Trend Microsystem Anti-Virus on the pre-screen questionnaire to protect her against viruses. Our discussion follows:

> J: "And are there, umm, any other sorts of programs that you feel like you need to keep your computer safe from these 'worms eating away at the computer's brains?'"
>
> S: "Um, I don't know what there is so, I rely on my IT person at the office to recommend what we need, and he has just put the Trend (Microsystems Anti Virus) on it. But uh, one of my solutions, but nobody one will listen to me…"
>
> J: "mmhh? Well I will!"
>
> S: "Well, I said to my husband, I said why don't they just get a Macintosh! 'Cause I understand Macintoshes don't get viruses, wouldn't it be way easier if it [sic] just got a Macintosh? If it were up to me, and it were just me, I would buy a Macintosh. But because we do work between our home and with the office *he* says they won't be compatible, or he's afraid they won't be compatible, or it will be a hassle to make them compatible. So for that reason I am locked into a PC. But if it weren't for the business I would just buy a Mac."

Once it became clear I was taking Christina's technical knowledge seriously her tone shifted. She switched from metaphorical descriptions to more concrete ones. It is unclear from this discussion whether she actually believes Macintoshes have no viruses or was just exaggerating as part of her enthusiastic appreciation of having someone to listen to her opinion. Regardless, here she is demonstrating technological knowledge that Macintoshes are less

susceptible to viruses and require less active security vigilance than Windows, and she feels her husband is not taking her proposed solution seriously. Her solution is a pragmatic one in that buying a Macintosh accomplishes the goal of secure computing environment without the need for additional software. Despite it being a much less time intensive solution to the same problem such a simple, self-contained solution, however, does not provide her with the opportunity to demonstrate as much technical mastery as her husband's PC use. Consequently, this likely affects her husband's perception of her solution. This is aggravated by her tendency to use metaphorical descriptions which draw from different domains such as "eating away at the computer's brains" rather than technical terms that demonstrate mastery and control. This suggests that the alternate metaphorical paradigm has the potential for being misunderstood.

At the same time, I would like to suggest, perhaps partially in response to not being taken seriously by their partners when doing technology work themselves, that women may be aware of this potential and use these metaphors, perhaps unconsciously, to minimize the perception of their agency to encouraging outside support. If women secure outside computing support in this fashion,

their technology needs are met in a fashion that does not require gender inauthenticity giving the largely male computer Outside-Support provider a chance to reaffirm his masculinity. For instance, Christina's abrupt change in tone once it became clear that I, unlike her partner, was taking her technical knowledge seriously, suggests she may have been doing that whether consciously or unconsciously.

Those seeking support from an Outside-Support Provider did so for only some activities, whereas for other functions, they relied on themselves. The individuals in Outside-Support Households demonstrate that an Outside-Support Provider is a resource that could not be relied upon, but rather the support is often a gift from a lover or a friend or even a perk from working at a company. Consequently, computing assistance may come with social obligations. Like the women in the Self-Support Households, they were performing computer-security-related childcare on their own. While I saw examples of women from all three categories manage their presentation of their gender and technical ability, women in Outside-Support Households were most likely to do so in a fashion that downplayed their technical abilities even for security tasks they performed themselves. As a consequence, needing to seek assistance

from the outside resulted in these women becoming dependent on an Outside-Support Provider to take care of their safety and security and prevented them from developing the skills needed to manage these tasks on their own. In the next chapter I will return to this theme of dependence and gender presentation, but before I do so, I will describe four households that employed a mix of these three approaches to meeting their technical needs. Again, this section serves to illustrate the transitory and contingent nature of household structures and approaches to meeting technology needs.

5.5 Blended Households and Households in Transition

Four households used a mixture of the above three approaches to achieve a safe and secure computing environment. This included a household of single men, a woman undergoing a divorce, and two elderly couples with adult sons living at home. Looking at these homes best illustrates how computing support changes as household structures themselves change.

The first two of these were actively undergoing or had recently undergone structural change. The Glenhaven household (SMO6) consisted of five single men, three of whom were interviewed. In some

respects, the owner of the home functioned as the Security Czar by setting up the network. One housemate was self reliant in all other respects, and the third still relied on the Security Czar of his previous residence, a close friend.

Aileen of the Broadview household (HH8), who was going through the a transitional period due to a divorce. It had been decided that the children would remain in the family home, with each parent spending part of the week with them. She had previously relied on her husband as a Security Czar. Because of the unique post-divorce housing arrangement, she planned to continue relying on him in the main house. In her own home, she was learning to support herself. This suggests that as households are reconfigured in response to life events, access to those on whom one is dependent for technology guidance may become limited or the person one looks to for support may change altogether.

The Sierra View and Faye households (HH4 and OC14) both consisted of elderly couples living with their adult sons. In both cases, the adult sons to some extent act as Security Czars. In one household, Louis (HH4) resents having to provide his parents with support and attempts to avoid having to do so, an attitude that is consistent with

Grinter's findings (Grinter, Edwards, Newman, & Ducheneaut, 2005). In the other household, Richard communicates technical knowledge well to his father, but he finds that his mother often "throws up her hands" in frustration. Consequently, in both cases the parents seek outside assistance. Unlike Outside-Support Households, however, neither household had a central Outside-Support Provider*,* which requires the coordination of potentially disparate technical knowledge.

The women in these elderly couples primarily sought help from men outside the home. Ila, a widow in the Sierra View household (HH4), used to rely on her husband but now relies on her three sons, her grandnephew, her late husband's stepson, and her new partner's son. During the course of the interview, she specified what kinds of assistance she received from each of these men. June and Manny (HH15) received additional assistance from their two grandsons. However, both of these women relied on their daughters for assistance with online shopping. Regardless of the gender of their helpers, these individuals received technology support from a variety of places and subsequently had to coordinate their care.

These transitional households illustrate how computing support patterns are transitory and adjust to life events. Death, divorce, new

jobs, moving, going off to college, and interpersonal relationships all can change how a household obtains its computing resources. Roles and responsibilities related to online safety and security are renegotiated accordingly in response to these events.

5.6 Conclusions

Households meet their technical needs in a variety of ways. Each of the three primary approaches discussed here—Security Czar Households, Self-Support Households, or Outside-Support Households has associated costs and benefits. As technical skills, household structure, and memberships change, these approaches are reinterpreted.

I have shown how centers of technical knowledge in the home affect how computing needs are met. Security-Czar Households tend to have a central point of knowledge. Households with multiple adults with balanced technical knowledge, or technically competent single individuals tend to provide their own support. Finally, households with less technical knowledge seek an Outside-Support Provider. However, as new requirements for technical knowledge emerge, resulting in new

opportunities to learn, the roles of Security-Czar and Outside-Support Provider are constantly renegotiated.

These renegotiations occur in response to changes in the home, which include household situational or structural changes as well as evolving technical abilities among household members. The renegotiation is tied to existing relationships with relatives, friends, neighbors, and colleagues. Renegotiations occur in response to these relationships and the roles with which they are imbued. In particular these relationships are forged around ideals of male power and control as expressed through "technology" (technology of course being male by default), and female nurturance of the families using technologies which are redefined as feminine. As role boundaries around new technologies are socially defined, this intersection is critical for understanding identity with regard to gender and technology.

Technical identity and gender identity are key subjects of this renegotiation as they affect gendered divisions of labor. Each of these three approaches to allocating security roles and responsibilities construct and adhere to gender roles differently. Our male Security Czars sought control and were responsible for all of the households' technology, including monitoring technology for children's activity.

Doing so removed all, or nearly all, computing tasks from the female head of household. While the female half of households with male Security Czars were reliant on their partners for security support, they were the only people for whom these technologies did not introduce additional work. They were also the only women for whom the introduction of computing into the home did not add an additional childcare task[15]. Our female Security Czarina accomplished these duties by herself, but she was careful to present them in terms of traditional duties of the housewife, while at the same time emphasizing her husband's technical ability. Other women sought help from outside the household, and while performing some duties on their own, downplayed their technical abilities. How these women presented their technical abilities with regard to agency was negotiated along with the types of computer-related work they performed. In the next chapter I will discuss how gender and technical identity are co-constructed for both men and women and how this influences the allocation of roles and responsibilities within the home.

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[15] It is true that the monitoring children's computer use does not necessarily represent new childcare work in that some activities which occur on a computer are replacements for other activities using older technologies for which women were responsible-- e.g. monitoring TV and phone use.

6 Constructing Gender & Technological Identity in the Home

6.1 Introduction

A key theme that emerged in my analysis of household members' efforts to keep their computers and the occupants of the home "safe and secure" were the links among gender, identity and technology. The privacy and security of the domestic computing space is negotiated and socially constructed. In the previous chapter I discussed the role of gender in technology support; here I will discuss how women and men co-construct gender identity and technology identity and how this, in turn, affects the divisions of roles and responsibilities for domestic end-user programming. Traditional nurturing roles are modified to encompass technology use—be it men providing for their families, or women caring for their children. In this chapter in particular, I discuss how gender and technological identity affects how individuals make decisions whether to engage in end-user programming at both an individual and household level. Before I begin discussing my data, I will provide a brief overview of the theories of gender and technical identity on which my analysis is based.

6.2 Gender Identity Theory

Before I can discuss how my participants constructed their gender identity with regards to technology, I introduce three different types of gender to disambiguate the terms' use. In order to introduce the concept of how femininity and masculinity are socially constructed, and I show how the concept of femininity and masculinity are defined relative to one another. In order to discuss the nuanced relationship of gender and technical identity, I introduce the concept of Gender Positionality and differentiate it from cultural feminism and post-structuralism. Finally, I broaden the scope by moving beyond a binary discussion of gender. In doing so, I introduce the theoretical concepts on which my analysis rests.

Gender is a broad concept and is used to describe a range of sub-topics. Here I am relying on Sandra Harding's research, which distinguishes among "Individual Gender", "Structural Gender", and "Symbolic Gender" (Harding, 1986). Her research on gender focuses on its role in science; consequently, her examples are based on science. Her first type of gender, Individual Gender, refers to a human's gender self-identification. Gender Structure refers to the social norms of how gender is divided by labor. Finally, Symbolic Gender, also referred to as gender totemism, is the assigning of gender to other characteristics beyond the individual and division of

labor. In a home domain, for instance, details of practice such as the Symbolic Gendering of appliances are included. Individuals' beliefs on each of these matters comprise their gender identities. These layered meanings of gender are negotiated, and they interact with one another as individuals manage their relationships with technology. Her typology, however, is more broadly applicable, and here I apply it to technology use in the home.

Foremost in my analysis is the notion that gender is not a fixed concept; both femininity and masculinity are socially constructed and undergo constant, albeit subtle, redefinition and re-inscription. At the core is the assignment of gender characteristics to the dualism of sexed bodies, or assigning passivity and nurturing to the feminine and aggression and providing to the masculine. Feminist philosopher Sandra Harding expands on this by saying, "gendered social life... is the result of assigning dualistic gender metaphors to various perceived dichotomies that rarely have anything to do with sex differences" (Harding, 1986, p. 17-8). This assignment of characteristics to a particular gender (for instance, women are graceful whereas men are strong) is not fixed, but rather socially and culturally constructed (Young, 2005; Butler, 2006). Consequently, Butler (2006) quotes Beauvoir: "'one is not born a woman, but, rather one becomes one'" (p. 11), and Butler adds that "gender is performatively produced…

gender proves to be performative—that is, constituting the identity it is purported to be" (p. 34). Butler argues that women do this in part by reaffirming and grounding the masculine identity of their partners; they deny and give up their own desire to participate in the desire of men. This process of "womanliness as masquerade" is discussed by Riviere (1929):

> Womanliness therefore could be assumed and worn as a mask, both to hide the possession and masculinity and to avert the reprisals expected if she was found to possess it . . . The reader may now ask how I define womanliness or where I draw the line between genuine womanliness and the 'masquerade.' My suggestion is not, however, that there is any such difference; whether radical or superficial, they are the same thing. (p. 38)

However these gender dualities come to be, it is clear they are complex and apply to different aspects of social life. Moreover, these complexities are under constant negotiation as we construct and redefine notions of gender. In my analysis, I discuss how the social construction and negotiation of gender relates to technology use.

A second component of my analysis rests on the idea that while all types of gender are socially constructed, there are inherent power imbalances. It is this power relationship which is the subject of Ortner's research (1974, 1989) (and later MacCormack & Strathern's research (1980) as well) relating nature and culture to femininity and masculinity. Ortner argues that the masculine is associated with the built environment and culture, and the feminine with nature, and by extension then, the masculine realm is that of the mind and the

feminine that of the body[1]. Consequently, she argues that as the mind controls the body, the masculine world controls the feminine world.

Therefore, if we consider the arguments of Ornter along with the argument of Butler, the feminine is defined relative to the masculine (Ortner, 1974, 1989), with women responsible for grounding masculinity (Butler, 2006). In my analysis, I consider how these power imbalances and grounding interact with our technology use.

This type of rhetoric requires a conception of woman, which has been a fundamentally problematic concept for feminist literature; therefore, a third component of my analysis rests on Gender Positionality, a different theoretical framework for conceptualizing women. Gender Positionality is an approach which improves on two primary approaches for conceptualizing women—cultural feminism and post-structuralism.

Cultural feminists such as Mary Daly and Adrienne Rich acknowledge contrasts between men and women but argue that men have unfairly defined women (Alcoff, 1998; Tong, 1998). They argue for a reinterpretation of the qualities assigned to women,

> Thus the cultural feminist reappraisal construes woman's passivity as her peacefulness, her sentimentality as her proclivity to nurture, her subjectiveness as her advanced self awareness… (Alcoff, 1998, p. 407).

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[1] Strathern's research (1980) on the Hagen, of course, shows this mapping is culturally arbitrary.

While cultural feminism turns negative attributions toward femininity upside down, Alcoff argues that doing so validates the patriarchy's negative assessment of women. Cultural feminism, she argues, entrenches these gender differences, which presents a problem for women who deviate from the norm.

On the other hand, post-structuralists reject attempts to define women, and instead focus on deconstructing the concept of woman (Alcoff, 1998). Doing so allows them to avoid entrenching gender norms and avoids what they argue is cultural feminism's main pitfall, that its redefinitions of gender are still based on misogynistic foundations. This approach allows women freedom to construct their own gender identities independent of cultural feminist definitions or the patriarchy. Further, through deconstruction it permits us to understand how gender is constructed as a cultural product. Alcoff argues, however, that this approach is all about deconstruction. Therefore, its limitation is that in that it does not define woman; consequently, it does not present a positive example around which one can structural political reforms.

The difficulty then is how to define a concept of woman that avoids a "generic human," without replicating patriarchal definitions. In her Gender Positionality framework, Alcoff presents an alternative to these approaches (Alcoff, 1998). Her approach is a metaphysical

one in that:

> Metaphysical problems are problems that concern factual claims about the world (rather than simply expressive, moral, or aesthetic assertions, e.g.) but are problems that cannot be determined through empirical means alone. (p. 429)

Creating a concept of women is one such problem. Broadly speaking, Gender Positionality[2] suggests that women are conceptualized relative to society, which is in a constant state of change, and *woman* is a relational concept is only identifiable in a context of constant change. Alcoff elaborates the relationship between women and society in a chess analogy.

> When the concept "women" is defined not by a particular set of attributes but by a particular position, the internal characteristics of the person thus identified are not denoted so much as the external context within which that person is situated. The external situation determines the person's relative position, just as the position of a pawn on a chessboard is considered safe or dangerous, powerful or weak, according to its relation to the other chess pieces. (p. 433)

Because society is in a constant state of change, Alcoff argues, our concept of women changes as well, although this change occurs

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[2] Gender Positionality and Standpoint theory (Hartstock, 1983) have both similarities and differences. Gender Positionality, like Standpoint theory is based on the belief that women have a different perspective from men which is critical to study, however Gender Positionality emphasizes the situatedness of this position. In feminist standpoint theory, writers use their own position and the access it affords them to analyze culture, whereas in Gender Positionality the theorist writes as an outside observer. Franks explains, "I refer to the way in which the individual identity and affiliations we have are positioned by *others*. Specific forms of feminism are situated as a response to the specific manifestations of patriarchal relations within any given culture or belief system. The notion of positionality is important as a counterbalance to the possible over-personalization of standpoint within liberal discourse as if it were always the outcome of choice." (Franks, 2002).

gradually[3]. Secondly, in constructing women's position, meaning is created and thus can be discovered; this meaning is part of an active process of redefinition and reinforcement and thus is not merely given. Alcoff (1988) expands on this by saying,

> …the position that women find themselves in can be actively utilized (rather than transcended) as a location for the construction of meaning, a place form where meaning is constructed, rather than simply a place from where meaning is *discovered* (the meaning of femaleness). The concept of women as positionality shows how women use their positional perspective as a place from which values are interpreted and constructed rather than as a locus of an already determined set of values. (p. 434)

Gender Positionality theory allows flexibility for the definition of woman to change radically at some point in the future, as domestic roles are modified in response to new technology. Further, Gender Positionality permits one to consider being a woman as a perspective from which values are interpreted and constructed. This would include women's values on technology as well as women's relationships to technology and to the symbolic gendering of technology. Gender Positionality serves as the basis for my analysis as it allows me to explore each of the nuanced relationship between gender and technology. The existence of gender and gender identity requires a concept of gender norms, but a binary set of gender identities assumes that gender follows sex, and that sex is unambiguous.

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[3] Of courses these changes occur in relation to other cultural institutions such as the patriarchy, which are themselves subject to redefinition and re-inscription in response to changes in gender roles.

The fourth and final concept I wish to introduce as a foundation of my analysis is that a binary concept of gender may be inadequate for the task at hand. Butler (1990) is arguing there is a heterosexual hegemony with regards to gender, based on Foucault she argues:

> The heterosexualization of desire requires and institutes the production of discrete and asymmetrical oppositions between 'feminine' and 'masculine'. (p. 23-4)

Butler adds that if a man can have either masculine or feminine characteristics, this mimetic relation of sexed bodies and culturally constructed bodies breaks down because:

> it is no longer possible to subordinate dissonant gendered features as so many secondary and accidental characteristics of a gender ontology that is fundamentally intact. (p.33).

Consequently, because it is impossible to reconcile these dissonant gender characteristics into a binary gender system, Butler is arguing for a more complex system of gender identity than that allowed by dualistic notions based on heterosexuality. For instance, Faulkner's ethnographic research on gender and technology illustrates that the relationship is more nuanced than what following binary patterns of gender only would allow. Faulkner's studies of gender and technology show that while we may *discuss* gender--including Symbolic, Individual and Structural--in a dualistic fashion, the underlying *behavior* is more nuanced (Faulkner, 2000a). With respect to each, these three aspects of gender are more complex than binary gender allows. Therefore, it follows that if gender identity requires more nuances, so, too, does the

Symbolic, Individual and Structural Gendering that organizes our relationships with domestic technologies. Consequently, in my analysis I use a non-binary treatment of gender to analyze these relationships.

To summarize, gender is socially constructed in such a way that it is only identifiable in the context of change. In other words, gender is not static but rather socially and culturally constructed in response to social changes such as new technology. This leaves even the dualism of gender open to renegotiation. Further, the concept of gender is rooted in power imbalances where women affirm the masculinity of men. The following section uses these theories as an analytical framework for discussing my fieldwork. In particular, I discuss the role of Symbolic Gendering and Structural Gendering as a means of understanding people's relationships with domestic technologies.

6.3 Gender and Technological Identity Theory

In this section, I look at how technical identity[4] relates to gender which, along with the gender theory just discussed, I use for further discussion and analysis of the data. I also reintroduce the gendered differences in attitude towards technology, and the concept of

[4] The colloquial definition of Technical Identity will serve at this point though I will later disambiguate some of its components to discuss its use in regards to women.

"Technology as Masculine" culture. Exploration of this gendered attitudinal difference allows me to draw parallels with patterns I observed in my own data later on. Further, I provide an overview of the literature on gender and technology, culminating in a discussion of Kvande's research (1999), which uses Gender Positionality and Sameness/Difference theory. Kvande uses these theories to articulate a set of approaches women use to construct their gender and technical identities in the workplace. Having examined Kvande's usage of the analytical tools of Gender Positionality and Sameness/Difference theory, and having established them as an insightful means of exploring the relationship between gender and technology, I will similarly examine my own data. Doing so allows me to discuss how men and women use similar strategies in the home and to characterize gender and technical identity in the home as an area of inquiry requiring further study.

In my discussion of related research I summarized differences between men's and women's attitudes towards technology. Men look to technology as a way of expressing expertise and control (Livingstone, 1992). Further, the masculine is associated with the built environment and culture; thus, technology is by definition part of the masculine (Ortner, 1974). Therefore, at present, masculine and technical identities are intrinsically linked, and affirming one affirms

the other. It is true of course, that these same masculine and technical identities are subject to redefinition themselves, including redefinition that dissociates one from another. However, as this historical connection exists, it is critical to bear this historical connection in mind when conducting analysis of this relationship in the present day.

The construction of female-gendered identity and how it relates to technology is more complicated. The "Technology as Masculine Culture" school of thought (Cockburn, 1985, 1992) suggests that the inherent male bias of technology is in part caused by women's lack of involvement in the design of technologies that are often shaped by male power and interests (Wajcman, 1992). As a result, women feeling alienated from technology define their femininity in terms of rejection rather than adoption of technology (Turkle, 1988). Thus some women may intentionally define themselves as not technological to preserve their femininity (Turkle, 1988). This makes it problematic for women to pursue technical interests both personally and professionally.

Yet the bulk of the literature looks at women, and more recently gender, in professional settings, often treating women as a single uniform category (Butler, 2006, p. 6). In doing so, portions of the gender studies literature formulates the problem as an examination of the relationship between women and technology. More specifically, the

focus is on finding out what characteristics (or lack of them)inhibit girls' success with technology (Harding, 1986, p.54). Moreover, there is a failure to examine androcentric properties of male scientific institutions, which raise barriers to women's successes[5] (Harding, 1986, p. 77). Others look for feminine characteristics in male scientists as a way to achieve gender parity in male institutions. Broadly over time, this debate has moved from a discussion of the role of women *in* technology, to the relationship between women *and* technology, and more recently the co-constructed relationship between gender and technology (Faulkner, 2001). Consequently, in my research, I look at the relationship between gender and technology in the home with an eye toward androcentric properties of both the home and its technology and cross-gender characteristics of people in the home. Contrary to Ortner (1974), who glosses over the home as female and thus not a site of technology production, I wish to consider the home as both masculine and feminine and as a site of technology production. Studying the home is especially important in that it acts as a training

[5] One key barrier to success is through the creation of Symbolic Gender Harding argues these symbols are articulated as the product of attempts to resolve both male identity conflicts and structured gender in society. Harding argues that with regards to science, gender totemism is "often energized by perceived oppositions or conflicts between masculine identity and threatened or actual divisions of labor" (Harding, 1986, p. 54).

ground for children, socializing them in societal attitudes toward gender and technology.[6]

While looking at construction of gender and technical identity in the home is a relatively new topic of study (Spender, 1995; Silverstone, 1992), several authors have looked at the source of this relationship by examining women's professional work in the technology sector. Here the usage patterns of extremely technologically savvy young men are used as a basis of comparison.

This type is referred to as a "geek" in the literature or as a "hacker" or "nerd" in common parlance; such types are stereotypically comfortable with technology and yet socially awkward. Faulkner paraphrases Turkle by saying "geeks" are,

> young hobbyists [who] often experience greater enthusiasm for, and competence in, interacting with the computer than with people; indeed for some, intimacy with the machine is a retreat from the vagaries of intimacy with humans" (Faulkner, 2000, p. 763).

Turkle's characterization of the "geek" is highly technologically competent and intimate with computers at the expense, or exclusion, of intimacy with people. Turkle and Faulkner argue this emphasis on intimacy with computers over people presents a potential obstacle for women who seek similar relationships with technology.

Turkle (1990) argues, for example, that for women, relationships

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[6] School, of course, also serves as an equally important training ground, but it is less relevant to this analysis.

with people are viewed as a natural part of gender identity. Turkle further suggests that women want relationships with people not machines. She quotes one subject as saying, "I don't like establishing relationships with machines. Relationships are for people." (Turkle, 1990, p. 152). Consequently, Turkle asserts, "Many women may be fighting *against* having a close relationship to a computer or to computational objects." If being a geek requires intimacy with machines, then this presents a problem for women. Turkle writes, "Thus, women are too often faced with the not necessarily conscious choice of putting themselves at odds either with the cultural associations of the technology or with the cultural constructions of being a woman." (Turkle, 1990, p. 151). By cultural associations, Turkle refers to the gender symbolism of the technology. Faulkner (2000a) argues that this rejection of the part of feminine identity concerned with forming meaningful social relationships can lead to a feeling of "gender inauthenticity" (p. 763). This Gender Inauthenticity is a source of tension for women working with software[7].

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[7] In his literature review, for instance, Huff reports on a related finding by Robinson-Staveley and Cooper, whose study showed that college-age female computing novices were less successful and experienced greater situational stress when performing tasks in the presence of another person Huff, 2002]. In this study, there is an inherent conflict for women doing these tasks in public that stems in part from gender. On the one hand, the women want to succeed to please the experimenter and to be helpful which is true to gender norms. On the other hand, demonstrating technological savvy requires a degree of Gender Inauthenticity especially if done in the presence of another.

Gender Inauthenticity is a major problem for female computer users. Huff reports on a related finding by Robinson-Staveley and Cooper, whose study showed that college-age female computing novices were less successful and experienced greater situational stress when performing tasks in the presence of another person (Huff, 2002). In this study, there is an inherent conflict for women doing these tasks in public that stems in part from gender. On the one hand, the women want to succeed to please the experimenter and to be helpful which is true to gender norms. On the other hand, demonstrating technological savvy requires a degree of Gender Inauthenticity especially if done in the presence of another. Performing the task in private requires less effort to consciously negotiate their presentation of gender, which subsequently reduces situational stress.

How women then go about resolving the tension is a subject of further study. Faulkner (2000a) looks at Gender Inauthenticity and how it affects career choice; she claims it propels women toward what she calls more feminine technical careers which she defines by example-- user interfaces, quality assurance, project management or management of people. She argues these careers are "ghettoized" within the software profession and are low-status from the perspective

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Performing the task in private requires less effort to consciously negotiate their presentation of gender, which subsequently reduces situational stress.

of the geek. Software jobs are solidly middle-class but have working class machinist origins. Ironically, while ghettoized and less technical, many of these feminine technical roles are often higher status than the position of geeks in the context of American society at large; being members of what Ortner (2003) now calls the "Professional/Managerial Class." Reconciling technical and feminine identities then is a source of tension, which is resolved as they are both co-constructed.

Kvande's research (1999) provides examples of how women in engineering organizations construct their gender and technical identity as they negotiate their femininity and position themselves relative to hegemonic masculinity of their corporate environments. It shows how women deal with technology to "strategically challenge the meaning of what being a woman implies through negotiations" in a workplace setting (Kvande 1999; p307). Historically, women have taken auxiliary or subservient positions in male scientific institutions or focused on women's fields such as home economics to intentionally camouflage their Technical Ability; by doing so, women protect their gender identity (Harding, 1986). Kvande's study shows how women in these organizations overcame these historical challenges. They were confronted with a "dilemma of difference," a decision on how to present themselves--should they be more or less different from men by making themselves more or less visible as women? This is part of a

larger Sameness/Difference debate in feminist theory (Scott 1988; West & Fenstermaker 1995; MacKinnon, 1987).

Sameness/Difference theory has its origins in the research of legal scholar Catharine A. MacKinnon (1987). She argues that there is a fundamental tension in enlightenment thought that espouses gender equality as a type of "Sameness," and a concept of sex that assumes "Differences." She argues that laws have attempted to protect women by codifying their desire for equality, but in the process, women being "equal to" men becomes women being "the same" as. Thus, in law men are the normative standard against which women are measured (MacKinnon, 1987). At some point, however, this desire for Sameness breaks down, for instance, with regard to pregnancy. She argues that while pregnancy may be protected legally, it is subject to a double standard.

> The philosophy underlying the difference approach is that sex is a difference, a division, a distinction, beneath which lies a stratum of human commonality, a sameness. The moral thrust of the sameness doctrine is to make normative rules conform to this empirical reality by granting women access to what men have access to: to the extent that women are no different from men, we deserve what they have. The differences branch, which is generally seen as patronizing but necessary to avoid absurdity, exists to value or compensate women for what we are or have become distinctively as women (by which is meant, unlike men) under existing conditions (MacKinnon, 1987, p. 33).

Kvande criticizes the Sameness/Difference debate for creating uniform categories which betray the underlying complexity.

> Differences between men and women do not mean that men have to 'reject' or tone down their gender status. This reflects how masculinity is hegemonic (Kvande, 1999, p. 306).

This fundamental tension is being resolved by both law and society and forms the basis of much additional controversy in feminist debate (Scott 1988; West & Fenstermaker 1995).

Kvande uses Sameness and Difference in her research to look at how women's

> negotiations concern whether the meaning of gender should mean sameness or difference from men, hence they negotiate how to relate to hegemonic masculinity, and in this influences the strategies the choose in response to men's masculinities(Kvande, 1999, p. 309).

Kvande's research looks at how Norwegian female engineers with graduate degrees negotiate their femininity in their primarily male professional environments. Kvande argues women employ four broad approaches in negotiating their femininity in response to men's masculinities. These approaches vary in whether they are Sameness or Differences strategies[8].

The women she studies are negotiating their relationships to these hegemonic institutions in which they are employed; consequently, she argues her research is a theoretical extension of Alcoff's Gender Positionality. Women's relationship to their corporate organizations and their presentation of gender are in a constant state

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[8] Further, there are demographic trends with regards to class and whether a woman has children, as well as the type of organizational structure.

of change. In this fashion Kvande's research builds on both Gender Positionality and Sameness/Difference theory to discuss how women construct their identity in relation to these institutions.

Kvande's four strategies are called: Homeless, One-of-the-Boys, Compensators, and Challengers. First, Homeless women, or those who have not found their niche in an organization, employ Sameness strategies, and have two key subtypes—young women who do not yet see a gender-political difference, and older women who choose not to challenge hegemonic masculinity. Homeless women, unlike their male colleagues, do not attempt to stand out, but instead hope to prove themselves by being "clever and kind" with the expectation that their competence will be rewarded. Secondly, we see women who aspire to be One-of-the-Boys. These women believe that gender is not relevant in the workplace (subscribing to Liberal Feminism), and unlike Homeless women, they break from gender norms by adopting male strategies to distinguish themselves and compete with men. They recognize competence is not enough and that success in this environment requires self-promotion. These women typically do not have children, and their careers often result in their being distanced from other women. Lacking female companions, they often find themselves in a social "no-man's land," and end up further ostracized from women by behaving as "social men." Third, Compensators have

"escaped or withdrawn" from the professional contest and look to outside interests (typically family and children) to compensate for an unrewarding professional environment. Oftentimes, these women began as One-of-the-Boys but saw their professional relationships change irrevocably as result of having children. These women are adopting a Difference strategy, albeit it not at work, by challenging the male norms. Finally, Challengers are actively pursuing a Difference strategy at work by combining a strong professional identity with having a family and are actively critical of the male hegemony of their organizations. Kvande's classification is problematic in its ability to include career-oriented childless women who challenge hegemony. She does not allow for childless women to achieve Challenger status; having a family is intrinsic to her definition, and her career-oriented One-of-the-Boys classification is defined as one that ignores gender's relevance. Despite these limitations, Kvande's research shows how women are constructing and negotiating the meaning of gender in technical organizations.

Women in Kvande's study had very clear ideas of how they could express their femininity appropriately inside a technical organization. For instance, one said, "A female graduate engineer cannot dress in lace and frills because she won't be taken seriously." Kvande argues that graduate-level engineering has been considered an "archetypal

masculine profession" because of masculinity's relationship to technology, which makes relevant how women express their femininity and negotiate it within such a male-dominated profession.

If women are so carefully managing and co-constructing presentation of gender and technical identity in the workplace, I wish to understand how co-construction of gender and technical identity occurs within households. I wish to answer questions such as how women reconcile the domestic environment's association with hyper-femininity and their need to use domestic technology; how women's use relates to men's presentation of their gender and technical identities; and how these tensions are resolved in the division of household technology roles and responsibilities. It is these questions I will attempt to answer by using Kvande's approach and applying it to the home. Kvande's research looked at gender and technology in the office, but it has two key limitations. The study was conducted with little attention paid to how Symbolic and Structural Gender were undergoing changes. Secondly, it discusses how women are negotiating their femininity and positioning themselves relative to the hegemonic structure of their corporate environments, but it does not consider how men may also be negotiating their gender identity. For instance, Turkle (1990) reviews Hapnes & Sorenson research saying it shows how male Norwegian hacker culture chooses to reject the nerd

imagine, looking instead for a high-tech identity that allows them to incorporate "feminine' characteristics" (Hapnes & Sorenson, 1995)[9]. Still, Kvande's research has applications in the home.

In using Kvande's approach to look at the home, key differences between the home and office become apparent. In her office study, Technical Ability was viewed as at odds with femininity yet necessary for women to perform their job functions. In the same office, there was no perceived conflict for men; use of the technologies affirmed their masculinity. In the home, some technologies have acquired a feminine Symbolic Gender that makes their use compatible with femininity. Other technologies have acquired a masculine gendering; use of these technologies by women can potentially conflict with femininity and simultaneously undermine masculine gender identity. For instance, consider the differences for a women's gender identity between using the telephone, a feminine technology which does not challenge her notions of Gender Structure, versus her using masculinely gendered consumer electronic goods which challenge her femininity. However, both the Symbolic Gendering of the technologies and the Gender Structure are both undergoing change in response to

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[9] Of course, the reported differences between Hapnes and Sorenson's work and Turkle's are likely rooted in cultural differences between the U.S. and Scandinavia. This is, however, tangential to my core point that neither piece of work discuses how men need to resolve conflicts with regards to technology and their gender identities.

the introduction of new technologies in the home and changing social gender norms. Just as women can be agents of change in redefining Structural Gender and Symbolic Gender by adopting Sameness and Difference strategies, I argue that men, too, can deviate from gender norms and can themselves adopt Sameness and Difference strategies. Men, too, are occupying different forms of masculinity and negotiating different gendered strategies, though the literature has been less forthright in discussing them. Consequently, not only are women negotiating their identities, but men are doing so too, and these roles are being actively negotiated in response to one another. The next section returns to my data to interpret it in light of Kvande's research.

6.4 Discussion: Gender & Technical Identity in the Home

Women and men make strategic decisions as to how to present their technical abilities and gender. It can be argued whether these decisions are conscious or subconscious, but I argue they are negotiations in response to hegemonic norms that associate power with technology, technology with masculinity, and avoidance or fear of technology with femininity. Men and women enact these roles as they decide how and when to engage with technology. In this section, I

discuss how men and women in my study co-constructed their gender and technical identities.

6.4.1 Constructing Masculinity in Relation to Security

If femininity is constructed as the absence of the masculine, and women are a relational concept only identifiable in a state of change, then masculinity itself must be constantly reaffirmed. Kristin Day argues that by showing their strength and generally acting like a "bad-ass" with other men, men reinforce their masculinity (Day, 2001). With women, however, this has a negative effect, so men use chivalry as a way of demonstrating their masculinity.

Day's research looks at ways in which masculinity is constructed in relation to public spaces in Irvine, California. Irvine is heralded as an extremely safe city (Emmons, 1996), and yet in Day's study, "More than half the participants described women's fear in public spaces as either too little or as the 'right' amount. Men supported the idea of Irvine and UCI public spaces as dangerous for women" (Day, 2001, p. 113). Day explores this dichotomy and suggests that insisting public spaces are dangerous affords men the chance to be chivalrous, thereby reinforcing their own desirability.

I wish to make the case that providing computer security may allow men an opportunity to demonstrate their masculinity in the home; being a security czar is the digital equivalent of walking a

woman home at night. It affords a demonstration of chivalry and thus allows assertion of masculinity, in part through mastery of technological complexity.

During my interviews the individuals providing support were primarily male. More specifically, I saw male Security Czars providing assistance in Security Czar Households and women in Outside-Support Households receiving help from male Outside-Support Providers. While I was not able to interview the Outside-Support Providers the male Security Czars in the last chapter all spoke consistently of a desire to control the computing environment of their households. Frank's comment (HH1) was typical, "nothing happens on it (the computer) that I didn't authorize… nothing comes off of it, nothing goes on to it." While these individuals may not have spoken particularly of a need to protect their partners, their language focused on controlling the computer, including both the activities, and the people involved. If masculine attitudes towards technology focus on control and mastery (Livingstone, 1992), and since control is a mechanism for achieving protection, it is not surprising that men would formulate their views of protecting women and children in these terms. In providing these computer support services, men reaffirm their own masculinity, because women reaffirm and ground their masculine identities in allowing men to control their computer use and thus protect them.

For men, engaging in security support for their homes represents a Sameness strategy, and we saw few men deviate from it. Of the 19 Technology Households with both a male and female member[10], only four were engaging in a Difference strategy[11]. These Difference strategies included incorporation of oversight technology management into the female-head-of household's role as wife (OC14--Baja). A second household's Difference strategy incorporated oversight of technology management into her role as office manager responsible for supervising IT staff (HH3-Vicksburg). Finally, two households Difference strategy was to divide security responsibilities among adults (HH2&7; Martin & West). Attitudes towards these Difference strategies varied between households and members.

When asked about the division of roles and responsibilities in the home, some members spoke to Difference strategies at length while others made no comment. The Baja household (OC14) with its Security Czarina husband was engaged in the most radical Difference

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[10] The exception being Miranda (SMO1) who was the sole member of a Self-Support Household with no additional members in the larger Technology Household.

[11] The fifteen households with a male security provider engaging in Sameness strategies include: the five households with male Security Czars, the Robin Hill Household (SMO3) a Self-Support households with no female members, the four Outside-Support Households whose Outside-Support Provider was a significant other, the Oak household (HH5) an Outside-Support Household whose husband preformed support functions when the company's IT department was unavailable, and the four blended households with male Outside Support Providers.

strategy, and included the only man I interviewed who attempted to justify his technical ability. Here the husband refused to be interviewed alone because of his limited technical knowledge. Being interviewed with his technical savvy wife allowed her to answer technical questions, which made his Difference strategy less apparent. During the interview I intentionally thwarted this approach by asking him technical questions directly which allowed me to understand his abilities. Interestingly, this prompted him to clarify that his lack of technical knowledge was due to his short attention span and not his technical abilities. This prompted his wife to justify his technical abilities in other realms--"he's the building guy, and he can build a house."

In the Martin and West Households (HH2 and HH7) the men were engaged in a Difference strategy, but to a lesser extent. They were responsible for their own technology needs thus preserving their masculinity, but they did not control their wives' usage as they were self-sufficient. These Difference strategies went unremarked upon by the men (the male head of household was not interviewed in HH3), which suggests that technical mastery for all technologies in the home is not necessary for construction of masculinity because of the existence of other opportunities.

This relationship is reciprocal. As Day reminds us, "Women may also try to invoke chivalrous masculinity in men as part of women's own performance of gender identities." Consequently, even in households where men did not remark on the Difference strategy, women may have done so. In the Vicksburg household (HH3), for example, Christina was the office manager responsible for calling the IT staff, yet she was careful stress her dependence on IT. And in the West Household (HH7), Kathy, despite her self-sufficiency in many tasks, said that she still would sometimes decide that, "it's his job, I do the dishes." Additionally, women's reliance on lovers as Outside-Support Providers in Outside-Support Households is testimony to the efficacy of this approach. Invoking chivalrous masculinity at the same time requires women's adherence to gender norms. Consequently, Gender Inauthenticity was problematic for these women as they spoke at length to explain their technical abilities.

Unfortunately, the specialization of a Security Czar or Outside-Support Provider presents a challenge for computer security in that the structure of households change and the computer support providers may come and go in individual's lives. Day points out that, "by calling on male protection, women reinforce traditional feminine identities that emphasize fragility and dependence." Women can lose access to their computer support provider when a relationship ends, be it due to

death or a relationship breaking up. For instance, when Ila's husband, in the Sierra View household (HH4), passed away, her relatives' efforts to fill his shoes required Ila's coordination of seven people providing advice. Similarly, after her divorce in the Lakeshore household (HH10), Lori looked to her company's IT group as a general Outside-Support Provider and to a friend to set-up her network. In both of these instances, individuals came to rely on someone else being responsible for computer maintenance and security, a tenuous situation at best. Given the gendered nature of computer security, this may potentially be a larger and more significant problem for women should they come to depend on a Security Czar or Outside-Support Provider only to lose them due to changes in household structure.

Day argues that this performance of masculinity and actions to protect women "may be only indirectly related to danger, and may effectively reduce women's freedom and independence in public space" (Day, 2001, p. 115). Similarly, demonstrations of masculinity through providing security serve to hamper women's mastery of end-user programming, leaving them vulnerable if changes in the domestic environment require them to take care of themselves. Women's allowing or encouraging Digital Chivalry might not stem from differences in interest or abilities, but as a means of negotiating Structural Gender as new technologies are introduced into the home.

For men, reinforcing technical identity served as Sameness strategy which also reinforced their masculine identity. Men were primarily engaging in Sameness strategies using Digital Chivalry as a way of expressing power and control, but this approach has a drawback of encouraging dependence, which in turn affects how women present their gender and technical identities. Men engaging in Difference strategies either shared or ceded control over technology to their wives. This required men to co-construct their gender and technical identities accordingly. In doing so, men lost the ability to affirm their masculinity through Digital Chivalry. Consequently, this affects how women constructed their identity in response.

6.4.2 Constructing Femininity in Relation to Security

In the next section, I look at how women construct their femininity in relation to security technologies, and how their constructions relate to the Sameness and Difference strategies employed by men. The women I interviewed had a range of different levels of technical abilities. Some were highly technical and felt their abilities were beyond comment; others interpreted their abilities in terms of Gender Structure; and others still denied their technological competence. These strategies may be complementary and may be used dependent on the situation, but my aim here is to discuss the range of strategies available to women for reconciling and constructing

their feminine and technical identities, particularly in terms of Presentation of Agency, Self-Efficacy and Technical Ability.

Before continuing, I want to differentiate among Presentation of Agency, Self-Efficacy and Technical Ability. In this context, Technical Ability means technical knowledge independent of action. Simply put, what one knows technically and how confident one appears to be regarding technology are two different things; one could, for example, be quite knowledgeable yet lack confidence. The latter, how confident one appears, is what we call Self-Efficacy. Self-Efficacy refers to one's predicted likelihood of success (Beckwith & et al., 2006). Beckwith and colleagues have shown that Self-Efficacy is core to understanding End-User Programming because of its link to tinkering; "Females should be encouraged to tinker because it helps them to be effective, with the important caveat that tinkering in a complex environment carries a risk of damaging the females' self-efficacy" (Beckwith & et al., 2006)[12]. Self-Efficacy as defined by Beckwith measures how confident one actually is, a difficult characteristic or trait to assess. How confident one appears to be may differ from how confident one really is as we have the ability to pretend that we feel differently than we really do. Self-Efficacy is a measure of an internal cognitive state, thus it is

[12] While her works suggests tinkering is disadvantageous for men, she affirms its benefits for women (Beckwith et al., 2006).

independent of displays of confidence, which are subject to acting and may, in turn, mask ability.

Independent of ability and Self-Efficacy is Agency. Agency as Gidden (1979) writes is a property representing an individual's capacity to engage in action and is a "continuous flow of conduct." Having agency, however, does not mean one accepts responsibility for one's actions. Ortner builds on this theme in her discussion of Agency as it relates class and "various forms of inequality," of which gender is unquestionably a part in Western society.

Ortner's "Ethnography Among the Newark" discusses how her American informants tended to "change the subject" when they are asked to discuss topics related to class. By changing the subject, she does not mean so colloquially, but rather in the semantic sense. She is saying women are attributing their actions to others. However, she then immediately broadens her usage of how people "change the subject,"

> …it can be thought of with respect to questions of selfhood, personhood, agency—the subject—in the context of a discursive formation that hides class and blames the victim. White, middle-class males generally "have" (and see themselves as having) more agency than anybody else; the saleswoman who fought a brilliantly successful custody battle is nonetheless discursively disabled from seeing her own agency: "I never ever thought that I was the strong one in *anything*… I'm almost so passive that I don't get up to walk from here to there." The question of "changing the subject"—of being or not being the author of ones actions, or having or not having agency—should thus be thought of in the context of various forms of inequality, including class (Ortner, 1995, p.270).

In the same way Ortner argues that class contributes to this woman not recognizing her own Agency with regard to her custody battle, I argue that gender is a contributing factor to women failing to recognize their own Agency as it relates to the their technology successes. The woman in Ortner's example may have Agency, but by "changing the subject," she demonstrates she does not recognize her own ability to engage in and direct her actions-- she fails to recognize her own Agency. Women negotiate their presentation of their technical Agency, along with their actual Technical Ability and gender presentation. Further, this negotiation of presentation of technical Agency is done in concert with Structural Gender. An assertion of technical Agency by a female member of a household could be perceived as a direct rebuff of digital chivalry and a diminishment of the masculinity of her partner. As such, this gendered negotiation is a complex constellation of goals and considerations.

I want to further distinguish between Self-Efficacy and Presentation of Agency. Regardless of one's actual confidence in one's abilities, Presentation of Agency involves how one presents these abilities and accepts or denies responsibility for one's actions. One could own one's technological successes, which result from skill; one could own one's technological successes that result from luck; one could consciously disavow one's success; or one could deny success

without conscious intent. Each of these is an example of negotiating Presentation of Agency. Presentation of Agency can make it difficult to determine a person's true Self-Efficacy.

Therefore, when I speak of Technical Identity, I am referring to how people choose to show Self-Efficacy, how they present Agency, and how they have acquired Technical Abilities. Next, I will discuss four approaches women use with regard to technology and Presentation Agency. I define these as follows: "Geeks" who accept Agency without comment; "Good Women" who negotiate Presentation of Agency by redefining Structural Gender; "Damsels in Distress" who negotiate Presentation of Agency by relying on Structural Gender; and "Technophobes" who attempt to construct an identity without Agency.

6.4.2.1 Geeks: Accepting Agency without Comment

The first strategy we see women employ is being a Geek. Women such as Kate (HH2- Martin) and Miranda (SMO1-Ogden), embraced their technological interests without comment on them or their femininity. As outlined earlier, being technically sophisticated is challenging for many women, as interest in technology is often equated with being a geek, hacker, or nerd. Geeks are stereotypically characterized as comfortable with technology, having both high Self-Efficacy and are willing to show Agency. Yet they avoid personal relationships (Turkle, 1990), which raises an issue of Gender

Inauthenticity (Faulkner, 2000, p. 763). The women in this category exhibited these traits. Consequently, it begs the question of what aspects of these women's personality and backgrounds permit this sort of Difference strategy.

In looking at these women's backgrounds, it is perhaps unsurprising that they embraced their Technological and Gender Identity without comment.

Kate had more formal technical training with computing than any of our subjects[13]. Kate holds a master's degree in software engineering from a top-tier technical university. Her professional background required her to negotiate her Gender Identity to include technological competency. Being an engineer gave her a socially defined role in which she did not have to negotiate extensively to create a Difference strategy.

Miranda, on the other hand, had substantial but less technical education, a PhD in Information, but she, too, had a well-defined social role that allowed her to position herself contrary to Gender Identity norms.[14] Miranda was a lesbian, and as such is subject to

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[13] While Yan in HH6 did hold a technically oriented PhD her focus was in biology. Christina in HH3 subject of study for her Master's is unknown, but her interview revealed significant gaps in her technical knowledge---for instance not knowing that her firewall was disabled meant it was turned off--which suggest it was not computer related.

[14] Sexual orientation was not something I explicitly asked about, as my

different definitions of femininity, and by extension Gender Inauthenticity of technology may be less problematic.

Both of these women had constructed an identity that can be labeled with established attitudes towards gender or technology, which may have obviated the need for them to negotiate their gender or Technical Identity in daily conversation. Their example in terms of their high Technical Ability, Self-Efficacy, and Agency serve in marked contrast to the other women interviewed.

6.4.2.2 Good Woman: Negotiating Presentation of Agency and Technical Ability in Relation to Gender Norms

A second strategy was being a Good Woman, or negotiating Presentation of Agency and Technical Ability in relation to gender norms. I use "good woman" in the historic usage to mean one who is respectable in the sense that she conforms to social norms.[15] Women in this group had significant Technical Ability, yet during the interview

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employer had insisted I remove questions about sexual orientation from my interview materials. However, sexual orientation became apparent from discussions of household members and significant others. Miranda was the only woman who did not mention a boyfriend or husband, and my intuition was confirmed by a mutual friend. While I do not know for certain the other women in my study are straight, they are at minimum bi-sexual and currently engaged in heterosexual relationships.

[15] Harding uses the term to point out research which suggests women's contributions in scientific literature are not cited due to the "ancient but still viable" custom of not mentioning a "good woman's name in public." So, I borrow this term for a strategy that does technical work but renders it invisible to preserve femininity (Harding, 1986, p64).

constructed these abilities as part of the normative behavior of a "good" housewife, mother, or widow. Women in the Montelena, West, Baja, and Sierra View households (HH 5, HH7, OC14, and HH4 respectively) all exhibited such traits. These women moved past a feminine a-technological definition of self and were able to actively seek out technological solutions for themselves, but couched them in terms of socially accepted normative gender roles.

Yan, for instance, a Chinese divorcee with two young daughters was a member of an Outside Support Household who relied on her friend to select her computer and set up her wireless network. Yet she had sought out and installed Net Nanny on learning her daughter was approached by a stranger online and had had a bad experience (HH6-Montelena). While some of her technical needs were met by her Outside Support Provider, she showed technical skill in finding a solution to protect her daughters. In Yan's case, her areas of technical expertise were in line with gender norms.

A second such example is Kathy's assertion that she washes dishes and her husband does the computers (HH7-West). We know from the interview that the West home is a Self-Support Household and that Kathy has technical skill and performs a number of technical tasks around the house. Kathy stated a preference for not doing technical work at home, "she can do it all at the office but… [but at

home] I don't want to have to do tech", an attitude that allows her to leave her Technical Identity at work (along with the resulting gender insufficiency).

By referring to a gendered division of domestic work, Kathy emphasizes that doing technical work is not her job, which also helps camouflage her actual abilities. Kathy's "dangling a carrot" comment suggests that she encourages her husband to do tasks that she would rather not perform. She reasons that he can do them more quickly, but at the same time, she may be subconsciously giving him a chance for Digital Chivalry. Through this type of comment, Kathy is both managing her presentation of her Technical Identity and the time when things get done at home. Doing so allows her to succeed in accomplishing some of her technical tasks in a fashion that do not challenge normative Structural Gender. In short, she is giving her husband a chance to engage in Digital Chivalry while simultaneously preserving her desire for an a-technical domestic identity. At the same time, her comments serve to render her actual technical work invisible, which further strengthens the perception of Structural Gender.

Third, we see that Barbara, the Security Czarina of the Baja household (OC14), is responsible for the security in their household and has a small network of Apple computers. Despite Barbara's role as

Security Czarina, I explained in the last chapter how she and her husband attempted to present him as the technical person, and to redefine Barbara's role as Security Czarina in terms of housework.

A final variant was Ila, a widow with grown children (HH4-Sierra View). She spoke of her computer use in terms of her "caring" for her friend Frank by selecting clothing for him online. As a widow and retiree, she spent a significant amount of time engaged in charity work for her church, a socially accepted role for a women in her situation. She was in charge of contacting parishioners often via email, checking up on them after illness or surgery, and generally inspiring good will. Ila presented many of her technical abilities in terms of skills required for a charity worker.

In each of the households where we see Good Woman strategies in effect, we see how women's work with technology was presented in terms of the normative Structural Gender. In presenting technology tasks as an extension of these normative roles, women were to some extent following a Sameness strategy, thereby avoiding Gender Inauthenticity. Each of these women worked with the men in their households to construct their gender and technological identities in a fashion that at minimum did not challenge their masculinity, and in some cases, still afforded him a chance to engage in Digital Chivalry.

To some extent, these women were also utilizing a Difference strategy as they were engaged in redefining Structural Gender and Gender Symbolism in response to the new technology. As new technologies are introduced, the appropriate amount of technical know-how that is part of a feminine ideal is being negotiated, and these women were attempting to ensure that use of these new technologies fell within the realm of normative feminine behavior. Over time, as new technologies become commonplace in the domestic realm, new technologies lose their masculine status, and become femininely gendered (Fischer, 1992.). As such these technologies no longer challenge conceptions of a-technological feminine environment. We saw this with the telephone and the radio (Fischer, 1992; Harring, 2003). Modern home computing may follow a similar trajectory. Consequently, these technologies over time may require less negotiation, as they may become femininely gendered, but for the moment these women were engaging in an effort to negotiate and interpret gender roles with regard to technology.

In the future, Structural Gender norms to which the Good Woman aspires may include computer-related maintenance, and support may be redefined as just another type of housework. One can imagine a future homemaker's role being redefined. Responsibilities might include creating a wholesome computing environment and a

nice tidy network; ensuring that children are engaged in beneficial online activities; and selecting the latest security software as easily as she chooses throw pillows to complete the living room. For now though, these women are engaged in defining Structural Gender in relation to these new technologies. While these roles are being negotiated, Gender Authenticity for Good Women will continue to be a challenge requiring resolution. Good Women on the one hand have Agency, yet by working to make technology Symbolically Gendered female, they also undermine its status as "technology." These households illustrate how technology use, Agency, and significant technical abilities can be negotiated and presented in the form of normative behavior reaffirming femininity.

6.4.2.3 Damsels in Distress: Relying on Gender Norms to Meet Technology Needs

A third strategy involves women who de-emphasized their Technical Ability and actively sought out Digital Chivalry as a primary means of addressing their technology needs. In the Broadview, Lagunitas, Lakeshore and Hayworth households (HH8, 10, 11 and SMO4) we saw men, including boyfriends, ex-boyfriends, ex-husbands, and brothers serve as Outside-Support Providers. As members of Outside-Support Households, these women sought help with the selection of computers and major issues, yet they were responsible for

the day-to-day upkeep of the computers as well as their own identity protection. By relying on men to solve some of their technology needs, they simultaneously allow for displays of Digital Chivalry and re-affirmation of their feminine identity.

For instance, consider the plight of Lisa of the Lagunitas household (HH11), discussed in Chapter 5. Her boyfriend set up a new computer, but since it was a gift, she was not able to influence decisions such as choice of anti-virus package. Her boyfriend installed AVG, a popular Anti-Virus program because it was free and would not require an annual payment to update. She wanted to switch back to Norton, but did not know how. Since it was a gift, she had to wait for an appropriate time to ask for additional help and socially negotiate the situation so as not to appear ungrateful.

Alternatively, Kathy in her Self-Support Household, sometimes encourages Digital Chivalry because she wants to leave her Technical Identity at work. She feels her husband is more interested, can do it faster, and at the end of the day, she does not want to do it. Such an approach shows mastery of the resources at hand; however the Agency is to some extent second hand in that these women are not responsible for the technical tasks.

These women show Agency to the extent they consciously encourage Digital Chivalry. As discussed earlier in this chapter, this

situation presents a possibility for dependency and control. Still these women achieved their technology goals with little Gender Inauthenticity and very little identity maintenance required.

6.4.2.4 Technophobic: Attempting to construct an identity without Agency.

The fourth strategy women used was that of being a Technophobe. While some women demonstrated Agency without comment, and some carefully negotiated the presentation of their gender and technical identities, Technophobic women--despite having significant Technical Ability--attempted, either consciously or subconsciously, to construct an identity without Agency. Doing so projected an image of being fearful or separate from technology. Defining femininity by rejecting rather than embracing technology is in line with the theories of Technology as Masculine culture (Turkle, 1988) and also represents a Sameness strategy.

One example was Rati's assertion that the firewall is her husband's area and that knowing what it does did not necessarily mean she could set it up. Here she is showing little Agency for her ability, reinforcing a gendered division of labor regarding technology.

A second example is Christy of the Vicksburg household (HH3) whose situation was discussed at length in the last chapter. She was clearly capable of pursuing a security strategy of her own—getting a

Macintosh—and yet she is choosing to adhere to the strategy of the males in her life. In line with Ortner's saleswoman, she is "changing the subject" and making herself appear to have less knowledge than she does. I would further argue that by rejecting her own technological knowledge, defining herself as a-technological, and reinforcing gendered division of work, she preserves her feminine identity. Her behavior is consistent with the theory of Technology as Masculine Culture. Through these actions, Christy removes a potential challenge to her feminine image and allows her husband to reinforce his masculine image through a display of Digital Chivalry. Consequently, even masculinely gendered technologies can be used by women without challenging their feminine identity as long as they present themselves as having little Agency in their use.

A third example of this comes from my interview with June and Manny of the Faye Household (HH15), both of whom were in their 80s. Their extremely technically savvy 40-year-old son lived with them as well; he had been studying computers at university before being stricken with the disability that prompted him to move home. June was exceptionally nervous about the interview and her inadequate technical abilities, no doubt because they were far inferior to her son's abilities. She was so nervous, in fact, that had I not been friends with her grandson, I suspect the interview would have never taken place.

Due to time limitations, I interviewed the son alone, and then June and Manny together.

As the interview with the couple progressed, it became apparent that June was sitting there politely letting her husband answer the questions or by saying, "same as him." During the next phase of the interview, I asked how they would describe different security terms such as spam, virus, spyware, and firewall to a friend, assuring them that we were not trying to ascertain their technical abilities but rather trying to make sure we were using the same sorts of words in describing Norton products. In answering to the best of their abilities then, they were helping everyone who used Norton products by making the software easier to use. I had intentionally phrased the question this way to ensure that both men and women had a socially acceptable reason to answer it, which did not require Gender Inauthenticity. Otherwise, answering the question merely to demonstrate technical skill may have altered the presentation of Gender Identity I was studying in the first place.

To discourage June's tendency to agree with her husband, I intentionally asked her the question first. Both she and her husband knew what spam was, but when asked about viruses, June insisted she did not know anything about that. After a moment though she hesitantly volunteered that "viruses were something bad that

happened to computers." I was hoping to determine whether she really did not have the technical knowledge or merely thought such knowledge was not in her "job description," so I cautiously and matter-of-factly joked that she did in fact know something--that viruses were bad things that happened to computers. To avoid slanting the interview, I was careful not to tell her she was correct or praise her directly. Her facial expression and body language in response was extremely telling, showing a mixture of pride, presumably at having been correct, and embarrassment. Based on this interaction and the rest of the interview, I believe her embarrassment stemmed from her display of technical knowledge, which deviated from her gender presentation (as she showed no sign of having interpreted my indirect praise as condescending).

Her husband immediately added to June's definition that viruses can cause a computer to lose information and that the virus software was updated every January. In doing so, he affirmed his masculinity with his more technically complete answer than June's, and as such reaffirmed her femininity. Throughout the rest of the interview, this section of our conversation prompted more open and confident responses from June.

What I would like to stress here is the potential for a disconnect among actual Technical Ability, Presentation of Agency, and Self-

Efficacy. We have seen examples of this in the Vicksburg (HH3), Oak (HH5), Faye (OC15), and Sierra View (HH4) households. Additionally, the presentation of one's technical ability may change between the work and the domestic setting. For instance, Kathy lives in a Self-Support Household (HH3) yet claims that she does not engage in technology work at home despite performing it in the office. Further, as I suggested in the last chapter, motivation for this might differ. The presentation of one's technological ability may be influenced by a pragmatic division of labor, or it may be a desire to present oneself as more or less feminine. Regardless, such a division of labor typifies our definition of domestic femininity.

6.4.2.5 Four Strategies for Negotiating Femininity and Technology in the Home

In this section I have demonstrated four strategies women used for negotiating femininity and technology use in the home. I have shown that Technical Identity is complex and comprised of actual ability, Presentation of Agency, and Self-Efficacy, and that understanding true Self-Efficacy is difficult because it is filtered through Presentation of Agency. I have shown a range of different approaches to how women negotiate Agency with technology, and how they handle the potential for gender insufficiency. I do not wish to argue that these approaches are mutually exclusive, nor do I wish to

form a complete taxonomy of women's approaches to technology; instead, I hope to distinguish among the range of strategies I observed for identity construction.

6.5 Conclusions

This research allows us to understand a range of Sameness and Difference approaches used by both men and women to construct their Gender and Technical Identities. Additional research may introduce more nuances in approach, show how some of these methods are used in concert, or differentiate between the approach used with the casual stranger versus the long-time friend, lover, or professional colleague. Regardless, this research makes it clear that both men and women are co-constructing their Gender and Technical Identities, and as designers of technology, we need to take into account how our work challenges or supports Gender and Technical Identities.

In this chapter, I have shown how Gender Identity and Technical Identity are co-constructed in the home, and how gender norms factor into selection of a range of Sameness or Difference strategies used in domestic end-user programming. I have shown how most men engage in displays of Digital Chivalry and examined situations that permitted men to create their own Difference strategies. Similarly, I have shown four approaches as to how women present Agency with regard to

technology in the home--the Geek, the Good Woman, the Damsel in Distress, and the Technophobe. I have discussed how each of these approaches allows for presenting different levels of Technical Ability, Agency, and femininity. Broadly, I have shown how technology is being used as an object around which users are constructing their Gender and Technical Identities. In the next chapter, I shall discuss what this means for designers in HCI.

7 Discussion: Creating Technologies that Afford Co-Construction of Gender and Technical Identity

In this chapter I discuss the implications of my research. Specifically, I focus on its implications in terms of how to frame discussions of women and technology, and then what this means for both usability and design of technology.

7.1 Implications for How to Frame Discussions of Women & Technology

First, I wish to discuss what my study of the how suggests in terms of how we should frame discussion of work and technology. This work highlights the need to examine how we "do difference" by negotiating our Gender and Technology Identities through our usage of Sameness and Difference strategies. Further, we need to look at how technology influences our constructions of not only Gender Identity, but Structural and Symbolic Gender, as well. My work has shown the home is a place of co-construction of Gender and Technical Identities, as men and women attempt to negotiate both Gender Inauthenticity and changes in Structural Gender. The home is also a critical environment where we socialize youngsters in socially approved attitudes towards gender and technology, yet the co-construction of

Gender and Technical Identities in the home suggests a fundamental conflict for women who wish to engage with technology.

This study showed that gender influences how and under what circumstances security-work in the home is done. I argue that men and women are negotiating their co-construction of Gender and Technical Identity in response to their technology tasks. In some instances, individuals may engage with the technology themselves, whereas in other instances, social strategies can be drawn upon to achieve the high level goal of accomplishing the task.

Dividing security work along gendered lines results in women's dependency on men and is symptomatic of technology as masculine culture. This division of labor stems from how men and women construct their Gender Identities and relate them to technology.

Men are the principal creators of technology (Wajcman, 1992), and they look to technology as an avenue for mastery and control (Livingstone, 1992). Faulkner (2000b) reviews work by Kaufmann which examines how men's interactions with technology stem from them not feeling individually powerful despite having power as a group; moreover, Masculine identity is "fragile" and needs to be constantly proven (Harding, 1986, p104), by achieving a sense of control.

Digital Chivalry and the mastery of technology affirms masculine identity. Whereas, female identity is often phrased in terms of being a-technological making Gender Inauthenticity problematic for women interacting with technology. Women in my study used a variety of strategies to negotiate their Gender and Technical Identities to compensate for the potential of Gender Inauthenticity. Other research shows similar effects. Huff's research, for example, argues that women performing software tasks in private require less effort to consciously negotiate their presentation of gender thereby reducing situational stress. For women, this often means dependence on men. Doing so reinforces normative Structural Gender and socializes young girls in these attitudes towards technology. This hampers girls in the next generation's involvement in technology by further reinforcing the association between technology and Gender Inauthenticity for women. Feminist and queer theory, however, offer some promising insights to begin addressing this.

For instance, this research suggests that Structural Gender and Symbolic Gender interact to help determine how individuals negotiate their Gender and Technical Identity. As I alluded to earlier, a binary gender system is inherently problematic as an analytic tool[1], and much

[1] As I discussed earlier, binary gender may be used for everyday discussion of gender, but needs to be avoided as an analytic tool. For instance,

of this body of literature attempts to address this, especially the research of Butler and Young (Butler, 2006; Young, 2005).

Butler speaks to the difficulties inherent in being able to "subordinate dissonant gendered features" into a dissonant gender system (Butler, 2006). Our binary gender system and our associations between it and technology does not readily allow for women to engage with masculinely gendered technologies without losing femininity, nor does it allow men to cede control of these technologies without losing masculinity. My research shows how individuals (e.g. Barbara and Ken) challenge normative Structural Gender associated with heterosexuality (HH OC14) by engaging in Difference strategies which redefine it. Further, it illustrates how binary gender is problematic for technology use in the home.

Young (2005) in her research speaks of how transgression of normative heterosexuality means having no legitimate place in society. Young is discussing Calhoun's research on lesbian women, but I believe this also holds for individuals suffering from Gender Inauthenticity due to their interactions with technology. A-technical men and technical women were seen in my study, yet these Difference

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Faulkner's studies of gender and technology show that while we may *discuss* gender--including Symbolic, Individual and Structural--in a dualistic fashion, the underlying *behavior* is more nuanced (Faulkner, 2000a). Consequently, we need a richer vocabulary to discuss gender in a sufficiently nuanced fashion.

positions required substantial negotiation of Gender and Technical Identity. Similarly, Faulkner shows that our verbal descriptions of gender are more extreme and regulated than in practice and further that gender dualisms are often gendered contradictorily (Faulkner, 2000a). A non-binary model of gender that has more complexity and allows women and men to negotiate a variety of positions to their gender identity and feelings towards technology is required.[2]

I believe that Young's approach (2005) is an appropriate non-binary treatment for gender which can be used to further investigate use technology in the home. Young's approach dispenses with categorization of sex and gender, which Young argues is limiting. Instead, the Lived Body approach, as proposed by Toril Moi (1999), focuses on the physical experiences of the body in a particular socio-cultural context. In addition, the theory of a Lived Body is broadly in line with Positionality. While here I have focused on Gender Positionality, Positionality is part of a larger theoretical framework

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[2]Harding has argued that some of underlying issues relate to the role of childcare and housework in society. To her, the core issue behind under representation of women in technology is that women do not want to develop technical skills until the emotional, intellectual and manual labor of childcare and housework are respected by men. Until then, she argues, the intellectual and manual labor of science won't be perceived as valuable for women, and only once this occurs will the power dynamic inherent in our conceptions of normative gender realign. Further, you cannot ask women to degender without asking men doing the same (Harding 1986, p53).

which extends beyond gender. Similarly, the Lived Body can also encompass gender, social circumstances, race, and other aspects of the human experience. Both set an individual in a sociocultural context negotiating his or her position relative to the situation.

In the case of Positionality theory, women are conceptualized relative to society in that Structural Gender is subject to constant renegotiation and reinterpretation relative to society. Myfanwy Franks, an Islamic feminist scholar, expands on this

> By 'positionality' I refer to the way in which the individual identity and affiliations we have are positioned by *others*. Specific forms of feminism are situated as a response to the specific manifestations of patriarchal relations within any given culture or belief system… Positionality counters the over-subjectification that may take place in postmodern discourse on issues such as gender, power and ethnicity (Franks, 2002, p. 5).

In Positionality theory then, descriptions of self are anchored to cultural categories which are themselves changing. A drawback to this approach then is that it reflects the fluidity of the cultural categories themselves, such that it reflects any negative aspects of the categorization. Moreover, its reliance on the same binary gender system pervasive in society also differs from the Lived Body theory.

The Lived Body approach is not tied to definitions of gender, class, or race; instead its focus is experiential. It concentrates on the perspective of the individual living in a particular socio-cultural context, as Young explains

> The person always faces the material facts of her body and its relation to the environment. Her bodily organs have certain feeling capacities and function in determinate ways; her size, age, health and training make her capable of strength and movement in relation to her environment in specific ways. Her skin has a particular color, her face determinate features, her hair particular color and texture, each with their own aesthetic properties. Her specific body lives in a specific context — crowded by other people, anchored to the earth by gravity, surrounded by buildings and streets with a unique history, hearing particular languages, having food and shelter available, or not, as a result of culturally specific social processes that make specific requirements on her to access them. All these concrete material relations of a person's bodily existence and her physical and social environment constitute her *facticity* (Young, 2005, p16).

In this way, the Lived Body approach attempts to understand an individual's unique viewpoint in the context of a particular history and culture, rather than additively trying to combine differing labels of gender or race. While Positionality is dependent on normative categories of gender, a Lived Body perspective transcends them. Young writes

> the existential phenomenological category of the lived body is a richer and more flexible concept than gender for theorizing the socially constituted experience of women and men than the concepts of either sex or gender (Young, 2005, p. 25).

She continues describing the benefits of this approach

> Another reason that turning to a concept of a lived body may be productive for feminist and queer theory is precisely that it can offer a way of articulating how persons live out their positioning in social structures with the opportunities and constraints they produce (Young, 2005, p. 25).

Further, the Lived Body approach accommodates real world practice where class-based assessments are made in part due to gender; for instance, a woman's experience being considered less significant than

man's, no matter what her inner experiential life may be. The Lived Body approach, because of its emphasis on the perspective of the individual, incorporates these types of class-based assessments of ability by focusing on how these experiences alter the perception and interactions with the world around her. Just as the Lived Body approach can be used to understand feminine perspective, it too can be used to account for men's perspectives including their treatment of women. In these ways, the Lived Body approach gives us a non-heteronormative approach to gender which more readily allows for technical identities that thwart gender conventions.

While both of the Lived Body and Gender Positionality concepts have been discussed and applied in feminist and queer theory, my research shows their relevance to technology design. Lived Body and Gender Positionality both aid in describing how individuals negotiate their relationships with technology; interaction is more nuanced than simply interacting with technology along gendered lines. In particular, the non-binary notion of gender inherent in Lived Body is crucial for Science and Technology Studies in the home. While Positionality was critical in discussing how gender is a relevant question for technology designers, we need to continue the discussion of gender and technology use in the home in non-binary gender terms. This allows for a richer discussion of Technology as Masculine Culture and

technology's part in socializing girls into normative Gender Identities. With this in mind, let us turn to how technology may be evaluated and designed more effectively.

7.2 Implications for Usability

This research suggests three key implications for evaluation of HCI interfaces that result in changes to who we study, where we study it, and what we study.

First, when looking at who to study there is a need for increased diversity. My research makes it apparent that gender is a key issue for the usability of interfaces, particularly in the home. This makes the findings of my earlier research especially troubling; the HCI community is increasingly not reporting gender of subjects, and when we do, women represent only 29% of the subjects (Barkhuus & Rode, 2006). Clearly, we need to address gender balance in our study design, and work to compensate for the historical under representation of women in the studies to date.

Second, there is the question of where to study conduct studies. If technology is an object around and through which gender is negotiated and maintained and Structural Gender impacts usability of products, then in order to account for gender, usability research for multi-user products must occurs in the environments in individuals

construct their gender and technical identities. Single-user laboratory studies will not allow us to adequately design for gender. When choosing where to conduct evaluation we need to recognize that only by looking at environments which permit us to see gender and underlying social structures will we truly understand technology use; this means in particular there is a need for ethnographic research in real homes to achieve these goals.

Third, we need to change how we conceptualize what the appropriate focus is for usability research. I argue that if technology is masculine culture, then female users face an inherent usability problem which is further exacerbated by the gendering of valid scientific questions and the invisibility of women's worlds (Harding, 1986, p. 104). Harding's "The Science Question in Feminism" reviews Millman & Kanter's research[3] which argues that sociology's scope is limited due to "conventional field-defining models" established by the patriarchy. The scope of sociology models are inherently biased in a fashion that excludes women and women's issues. Of particular relevance to HCI, Harding (1986) reviews Millman and Kanter's argument that in sociology, a focus on Weberian rationality encourages the role of emotion to be downplayed in analysis. Our field's emphasis on cognitive modeling and task-based usability is indicative of this

[3] "Another Voice: Feminist Perspectives on Social Life and Social Science."

approach. We privilege cognitively and task-oriented based research over contextual research that includes impressionistic and emotional responses to interfaces set in the context of real constellations of relationships both with people and technology. Similarly, given Livingstone's research (1992) examining men looking to technology for a sense of mastery and power, and women looking to it for easing everyday life, one could argue a masculine bias in looking at technological "mastery" over task-based success that may involve "work arounds." This dominant Weberian influence towards task-oriented rationality, is creating a gender bias in how we are examining interfaces. We are failing to evaluate women's approaches to technology. This means that in order to account for gender, HCI studies need to focus on real-world situations and their accompanying contextual decisions.

For instance, consider Lisa of the Lagunitas household (HH11) whose boyfriend has set up her computer, and as it was a gift she was not able to influence decisions. As we learned in chapter 5, her boyfriend installed AVG, a popular Anti-Virus program, because it was free and would not require an annual payment to update. Yet once she started using it, she found she preferred the interface of Norton anti-virus, which she had on her old computer. She wanted to switch back, but did not know how. Further, she choose not to learn how to do so

herself, even though she was sufficiently technical to be able to run Norton Anti-Virus herself. Not only would explicitly rejecting such a gift potentially offend, but also demonstrating such technical independence would undermine such a demonstration of Digital Chivalry of her partner. Instead Lisa said was choosing she to wait for an appropriate time to ask him for additional help and socially negotiate the situation so as not to appear ungrateful. She explicitly chose to place more value on the social dynamics of the situation, instead of immediately solving her technical problems.

If we keep in mind the dominant paradigm–that of technological mastery as masculine–then we would have to judge this woman's achievement of her objective as a failure relative to technology. Therefore, perhaps we need to study different gendered paradigms of technology. Our success criteria for interactions with technology cannot be defined exclusively on a hegemonic masculine paradigm. Rather, we need to consider feminine definitions of task-based success without falling into a binary discussion of gender.

Only by addressing this inherent masculine bias in who we study, where we study, and what we study, will we cease using evaluation criteria which further perpetrate technology as masculine culture. By doing so, we can create technology which is usable for both men and women. Further, by combining this with a Lived Body

perspective on design it will allow us to depart from designing technology which is usable for only the "typical user" who is largely male, white, middle-class, well-educated and technologically sophisticated.

7.3 Implications for Designing Technology

The proverbial question at this point is what this means for technology design (Dourish, 2006), to which I offer three insights.

First, men and women possess different motivations for technology use. If men look to technology as a place for power and mastery, and women simply want control over and improvement in their qualities of life, then radically different usage strategies emerge. I have shown that men and women have a range of ways to negotiate their gender and technical identities. However, I have also shown the need for taking this range of approaches into account by designing technology that supports these negotiations rather than focusing on only technology designed for technical mastery. Designing for a user who is inclined to explore the interface and takes pleasure in complexity is different than designing for users who are reluctant to learn new technology without an explicit task in mind or those who are looking for satisficing strategies to meet their needs. In order to stop

designing for Technology as Masculine culture, this range of needs to be addressed.

Second, designers must recognize that technology serves as an object around which we negotiate and construct our technical and gender identities. We must be mindful of the political implications, and we must also make conscious, informed decisions regarding how to design for the bi-directional relationship of the social impacts of technology and the social shaping of technology.

Much like MacKinnon argues that legal precedent espouses an Enlightenment philosophy of equality, and therefore law is *designed* to accommodate Sameness strategies, technology designers often employ similar approaches. In not discussing the role of gender (Barkhuus & Rode, 2006) the hope is the technology will be equally usable by everyone. Masculinity is largely invisible in that is an unmarked category. My research has shown how gender affects how technology is used; explores strategies for using technology; and defines roles and responsibilities surrounding technology usage. Consequently, designers must design for change not just in terms of tasks, but in terms of the Sameness and Difference strategies we construct in using and negotiating our relationships with technology.

If the home is a primary environment in which we socialize youngsters in socially approved attitudes towards gender and

technology, then we have a crucial opportunity to subvert and change normative Structural Gender toward technology. We have the opportunity to design technology that resolves the Gender Inauthenticity that results from going against Structural Gender when using technology. In doing so, we can address the fundamental conflict in the co-construction of Gender and Technical Identities in the home, which hampers women's full participation in technology. Removing the barrier of Gender Inauthenticity opens the technology sector to increased female participation and subverts Technology as Masculine Culture.

Third, rather cyclically, we need greater involvement of women in the design process. As highlighted above, we need to ensure that proportional numbers of women using the technology are studied in settings where usage patterns related to gendered identity become apparent. At the same time, we need greater involvement of women in the creation of technical artifacts. Presently, men predominate in both technical education and in technical professions, thereby perpetuating Technology as Masculine culture. Some of the spaces in which we use technology and where we negotiate our co-construction of Gender and Technical Identity are highly gendered themselves. Women are privileged in their ability to gain access to these spaces, and as we learn from standpoint theory (Hartsock, 1983) women have critical

differences in perspective which we must incorporate into design, and take advantage of in design. This access, and the female standpoint from which to interpret it, is critical to the design of gender-aware technology. Given the culturally arbitrary mapping of masculinity and technology (Strathern, 1980) we can design technology as an agent of social change to directly attack this relation. Further, we can proactively design technologies in a fashion that combats the traditional masculine power of technology, in so doing we achieve gender-equity with regards to technology.

In sum, designers must move beyond binary notions of gender and design technology for the Lived Body experience. Ironically, given how the co-construction of gender and technical identity is changing in response to technologies, designers must design accommodate Differences that are being negotiated in response to the very artifacts they themselves are creating. Recognition of each of these challenges opens the design space to new challenges that will resolve the relationship between gender and technology.

7.4 Conclusions

In this chapter I have demonstrated how my ethnographic research raises new questions for studies of gender and technology;

suggests changes to how we should evaluate our interfaces; and provides insights into how we should go about designing technology in the first place.

8 Conclusion and Future Work

8.1 Introduction

In this dissertation I have demonstrated that technology is an object around which individuals negotiate their Gender and Technical Identities. I have shown what this means for the usage patterns surrounding technology, and also how this fits into the larger feminist agenda. This suggests the need for a program of Gender-Aware Technology design which is mindful of the bi-directional nature of technology's ability to socially shape society.

My characterizations of gender and technology have been grounded empirically in my study of usage of technology to achieve safety and security in the home. This study has led to insights in the co-constructed nature of femininity and masculinity, and of technical and a-technical identities, and how we negotiate them in deciding when and under what circumstances we engage in end-user programming in the home. As the home is where we instill the values in the next generation, this research shows that we have a great opportunity to challenge normative definitions of a-technological femininity in future designs.

In this concluding chapter, I will review my major contributions and discuss future research.

8.2 Study Contributions

I conducted interviews in 20 households comprised of 50 individual interviews (31 adults, and 19 children) to understand usage patterns surrounding safety and security of home computing. In doing so, I sought out answers to my research questions.

In chapter one, I set out to answer four questions:

- First, are there differences in how individuals go about programming "masculine" and "feminine" appliances, and how are these tasks treated in terms of technological complexity?
- Second, given the gendered nature of appliance programming, how does gendering affect interactions with technology, especially with cross-gendered appliances in terms of self-efficacy and the ability to program?
- Third, does the level of technological complexity in a household affect who programs what, and does it influence household members' attitudes towards programming these devices?
- Fourth, how do the social dynamics of the household interact with women's ability to program and to tinker?

In the following section, I answer these four questions and describe my major contributions.

8.2.1 Symbolic Gender's Relevance to Programming in the Home

Are there differences in how individuals go about programming "masculine" and "feminine" appliances, and how are these tasks treated in terms of technological complexity?

Symbolic gendering of appliances does matter when it comes to programming but more in terms of determining individuals' likelihood of programming rather than their ability. By defining an appliance as femininely-gendered, its status as a technology is undermined. While this allows women to program appliances without issues of Gender Inauthenticity, use of femininely gendered appliances does not reaffirm men's masculinity in terms of technology. Consequently, Digital Chivalry is less rewarded for feminine appliances, which makes programming of feminine devices more likely to follow a Structural Gender strategy. With masculine appliances, men do have the opportunity to demonstrate Digital Chivalry, or to reaffirm their masculinity when programming these appliances for themselves. For women, however, programming of masculine appliances results in Gender Inauthenticity. The subsequent conflict with Structural Gender also provides a disincentive to program these technologies. In my studies, I observed that women either adopted a Difference strategy by becoming a Geek or Good Woman or ran the risk of learned

helplessness by becoming dependent on others as a Damsel in Distress or Technophobe.

My findings suggest that decisions to program are based less on confidence and ability to program and more on Gender and Technical Identity. Programming of same-gender devices has more gender authenticity, and for men, programming masculine devices for women allows them to demonstrate Digital Chivalry. For women, I have demonstrated that the Gender Inauthenticity that results from programming cross-gendered devices, which includes computer-based security tasks, requires use of a Difference strategy to negotiate Gender and Technical Identity.

8.2.2 Symbolic Gender and Appliance Use

Given the gendered nature of appliance programming, how does gendering affect interactions with technology, especially with cross-gendered appliances in terms of self-efficacy and the ability to program?

Symbolic gendering of appliances also affects Self-Efficacy and Agency. For women, however, the distinction between Self-Efficacy and Agency is especially relevant. Women who are dependent on the Damsel in Distress or Technophobe strategies to negotiate Gender and Technical Identity may appear to lack Agency, but this is a different issue than Self-Efficacy. In terms of men's confidence levels when

programming cross-gendered appliances, additional research is required. My studies demonstrate that Gender and Technical Identity for men engaging in Sameness strategies do not alter Self-Efficacy or Presentation of Agency for programming masculinity Symbolic Gender devices such as home-security configuration. Based on these results, one could infer that men's encounters with feminine devices may be situational. While it may be acceptable to assist or repair a device, assuming primary responsibility for daily uses may damage masculine identity. Therefore, additional research is required to look at how men's end-user programming affects gender, especially men engaging in Difference strategies. Regardless, the Symbolic Gendering of appliances is an important factor in terms of end-user programming and Self-Efficacy. Programming of cross-gendered appliances introduces a greater sense of Gender Inauthenticity, which encourages people to follow Structural Gender.

The resulting Gender Inauthenticity may impair actual programming ability. Huff's research (2002) argues that women performing software tasks in private require less effort to consciously negotiate their presentation of gender-reducing situational stress. Women engaged in end-user programming alone can focus more of their energies on programming. Consequently, Gender-Inauthenticity that detracts from and ultimately hampers learning, which in turn

influences ability, may occur for women programming a cross-gendered device. This suggests that the Symbolic Gendering of appliances has detrimental effects on their usability by individuals whose presentation of gender differs from the devices' Structural Gender.

8.2.3 Technological Complexity and Role Allocation

Does the level of technological complexity in a household affect who programs what, and does it influence household members' attitudes towards programming these devices?

If women mask their Self-Efficacy with their Presentation of Agency to compensate for the Gender Inauthenticity associated with technology use, then use of extremely sophisticated masculine appliances would generate the greatest degree of Gender Inauthenticity for women. Consequently, these appliances are most likely to result in a decrease of Agency, and due to Structural Gender, women are less likely to want to learn to program them. However, my research does not address Self-Efficacy, which this study was unable to measure directly.

It is difficult to assess core "ability" as it is being masked by co-construction of Gender and Technical Identity. What is clear is that more women will actively engage in programming only if Gender

Inauthenticity created by not following Structural Gender norms is addressed.

8.2.4 Social Dynamics of the Household & Women's Programming and Tinkering

How do the social dynamics of the household interact with women's ability to program and to tinker?

My research shows that Digital Chivalry is core to the masculine identity and has positive effects that reaffirm femininity as well. However, Digital Chivalry also hampers women's ability to learn how to engage in technology tasks and creates a sense of learned helplessness. Digital Chivalry has detrimental effects on tinkering. Beckwith (2006) research suggests women learn best by tinkering, yet my results suggests that women affirm their femininity by co-constructing their Gender and Technical Identity in ways that limit their Presentation of Agency. This means women are more likely to receive offers of Digital Chivalry, which preempt their tinkering opportunities. The negotiation of the co-construction of Gender and Technical Identity means allocating responsibility as best suited to the household's co-construction of Structural Gender and solution of immediate programming needs, which may be at odds with long-term tinkering and learning strategies.

8.3 Future Work

My dissertation suggests a need for additional research in order to: 1. learn more about the types of strategies used by people to negotiate Gender and Technical Identity in the home; 2. understand the Symbolic Gendering of objects; 3. take concrete steps toward developing guidelines to ensure Gender-Aware Design; and 4. move beyond gender to apply the Lived Body and Positionality perspectives more broadly as analytical tools for understanding the relationships among individuals, groups, and their constellations of technology. Next, I will discuss the specifics of the first two areas of research and outline how understanding them will influence design and allow an expansion of scope beyond gender.

8.3.1 Sameness and Difference Strategies

My research findings have outlined some of the Sameness and Difference strategies used in the home, but additional research using a similar gender perspective is required. I have laid out the basis for a number of strategies which women use, but a fuller understanding of these strategies, how they are combined, and under what circumstances they are employed is necessary. Additionally, my research suggests that while much is known about women's interactions with technology in the home, little is known about men's

interaction with domestic technologies because this study primarily captured men's reliance on Sameness strategies. Additional research is required in homes where men and women are negotiating Difference strategies with regards to technology; doing this will allow for an understanding of how men and women subvert and negotiate normative Structural Gender. This type of research will also allow us to understand the social shaping possibilities of technologies that change Gender Identities. Such research will, in turn, allow us to make better-informed design decisions.

8.3.2 Symbolic Gendering of Appliances

Additional research related to the Symbolic Gendering of appliances is required. In this dissertation I have emphasized the need to avoid binary structures of Individual Gender; at the same time, Symbolic Gender has proven vulnerable to a similar binary treatment. Not only is there a need to understand how appliances acquire their Symbolic Gender, there is a need to understand how this gender is contextually interpreted in light of a non-binary construction of Symbolic Gender.

8.3.3 Designing Gender-Aware Technology

Understanding how the usage of both Sameness and Difference strategies can be applied to Structural and Symbolic Gender leads to a

focus on Gender-Aware Technology design, my third area of related research.

In particular, while technology designers in the CHI community go to great lengths to accommodate users and their needs, gender considerations are rarely discussed. With MacKinnon's research (1987) as a basis in chapter 6, I discussed the role of equality in Enlightenment thought and its influence in legal precedence in the United States. MacKinnon's research further suggests that Enlightenment thought espouses gender equality as a type of "Sameness" but that a concept of sex that assumes "Differences." We protect women legally by codifying their desire for equality; as a consequence, however, being "equal to" men becomes women being "the same" as men. MacKinnon suggests the result is men becoming a normative standard against which women are measured, and this is codified in legal precedent. I have argued Enlightenment philosophy combined with legal precedent also influences design.

As in the legal field, we technology designers are also susceptible to the same sort of tension in trying to reconcile "Sameness" and "Difference" in our design strategies. First, I would argue that we, as a community, subscribe to Enlightenment philosophies. Interest in technology being equally usable for men and women is a dominant value held by members of our community and

reflected in studies of women's use of technology (e.g. Beckwith, 2006; Kelleher, Pausch, & Kiesler 2007). It is not yet reflected, however, in design practice (save perhaps for the Value-Sensitive Design campaign (Friedman, 1996)). Designing for equality would mean designing for Sameness, the hope being that technology would become gender neutral and accessible by all. Unfortunately, technology's tendency to reflect primarily masculine culture undermines this goal.

Second, a focus on user-centered design recognizes the uniqueness and variety of individuals within user groups. Such an approach has the potential to accommodate design along Difference lines including gender. The Technology as Masculine Culture school of thought would suggest that technology befits the needs of male users, thus Differences can only really be negotiated in response to female users. The dominant User-Centered Design practices in our community have an evaluation component, but I have shown (Barkhuus & Rode, 2006) that designing primarily for female users rarely occurs. Moreover, in our survey, we found few examples of evaluation focused primarily on female users (Dey, & de Guzman, 2006; Egido, & Patterson, 1988.). Regardless, the concept of Technology as Masculine Culture would likewise undermine designing for Difference

because of the prevalence of men as creators of technology and hegemonic cultures in which technology is created.

MacKinnon argues that legal scholars must strive to reconcile the written body of law's treatment of sex and gender as having both qualities of Sameness and Difference. Similarly, I argue that within the HCI field, we need a consistent treatment of gender in our designs. Awareness of Sameness and Difference strategies used to negotiate Gender and Technical Identity is only the first step in a program of design. Understanding how difference strategies subvert Structural Gender and how Structural Gender potentially undermines women's opportunities to become engaged with technology, intensifies our obligations as designers. We, as researchers, need to make responsible technology design decisions as to how we are going to handle the role of gender. This adds another thread to the ongoing debates about the ethical and moral components associated with technology design.

8.3.4 Moving Beyond Gender

If technology acts as an object around which we negotiate our presentation of Gender and Technical Identity, and if we move beyond a primary focus on Gender Positionality to the broader context of Positionality and the Lived Body experience, then technology also appears to serve as an object around which we negotiate our

constructions of class and race. While my research suggests the importance of this perspective, more research is required to understand how our Lived Body experience and our Positionality affect our interactions with technology. Ultimately such factors may limit the usability of and access to technology itself.

8.4 Conclusions

This dissertation has demonstrated how gender is core to how to how we use technology, and as such needs to be explicitly addressed in its design. Symbolic gendering of devices as well as Structural Gender affects how we negotiate the roles and responsibilities surrounding their use.

By looking at End-User Programming, I have shown inherent tensions in Structural Gender as it applies to home security. Structural Gender is comprised of a cultural image of nurturing and protection of children as a female role, with care for technology and protection of women as a male role. This normative organization of gendered family life impacts how individuals negotiate and present Gender and Technical Identities as they decide to adhere or resist or reinterpret normative patterns.

As such, my study of End-User Programming demonstrates gender's importance beyond how it is typically discussed within the

design and Human Computer Interaction communities. Technology is an object around which we negotiate gender, but beyond gender, a cultural reading of Positionality and Lived Body experience suggests a close connection between other factors such as race and class. Similarly, how we use and engage with technology significantly broadens the scope of design challenges.

References

1) Alcoff, L. (1988). "Cultural Feminism versus Post-structuralism: The Identity Crisis in Feminist Theory." *Signs* **13**(3): p405-436.
2) Antonides, G., and van Raaij WF (1998). *Consumer behaviour: a European perspective.* Chichester, Wiley.
3) Barkhuus, L. and J. A. Rode (2007). "From Mice to Men: 24 Years of Evaluation at CHI" *Alt.Chi*. 2007.
4) Beckwith, L., C. Kissinger, M. Burnett, S. Widenbeck, J. Lawrence, A. Blackwell, and C. Cook (2006). *Tinkering and Gender in End-User Programmers Debugging*. *CHI,* Montreal, Quebec Canada, ACM Press. p231-240.
5) Berg, A.-J., and Merete Lie (1995). "Feminism and Constructivism: Do Artifacts Have Gender?" *Science, Technology and Human Values* **20**(3): p332-351.
6) Berk, S. F. (1985). *The Gender Factory: The Appointment of Work in American households*. New York, Plenum.
7) Blackwell, A. F. (2002). "First steps in programming: A Rationale for Attention Investment Models." *Proc. IEEE Symposia on Human-Centric Computing Languages and Environments*: 2-10.
8) Blackwell, A., and R. Hague (2001a). AutoHAN: an architecture for programming the home. *Proceedings of the IEEE symposia on human-centric computing languages and environments.* Stresa, Italy. p150-7.
9) Brumitt B, B. Meyers, J. Krumm, A. Kern, and S. Shafer (2000) EasyLiving: technologies for intelligent environments. Proceedings Of the 2nd International Symposium on Handheld and Ubiquitous Computing (huc2k), Bristol, UK, September 2000. p12–27
10) Bureau of Labor Statistics (2004). Employment status of the civilian noninstitutional population 16 years and over by sex, 1970-2004 annual averages <http://www.bls.gov/cps/wlf-table2-2005.pd
11) Butler, J. (2006). *Gender Trouble.* New York, Routeledge.
12) Camp, T. (1997). "The incredible shrinking pipeline." *Communications of the ACM* **40**(10): p103-110.
13) Cockburn, C. (1985). *Machinery of Dominance*. Boston, Northeastern UP.
14) Cockburn, C. (1992). The circuit of technology: gender, identity and power. *Information and communication technologies in the home.* New York, Routledge.
15) Schwartz-Cowan, R. (1983). *More Work For Mother: The Ironies of Household Technology from the Open Hearth to the Microwave.* New York, New York, Basic Books.

16) Darrah, C., J. English-Lueck, and J. Freeman (2001). Families and Work: An Ethnography of Dual Career Families. *Final Report to the Alfred P. Sloan Foundation* http://www2.sjsu.edu/depts/anthropology/ svcp/SVCPslnr.html, 2001.
17) Day, K. (2001). "Constructing Masculinity and Women's Fear in Public Space in Irvine, California." *Gender, Place and Culture* **8**(2): 109-127.
18) Deem, R. (1986). *All Work and No Play? The Sociology of Women and Leisure.* Milton Keynes, OU Press.
19) Dey, A. K. and de Guzman, E. 2006. From awareness to connectedness: the design and deployment of presence displays. *In Proceedings of CHI '06*. ACM Press, New York, NY, p899-908.
20) Dillman, Don. (2000) Mail and Internet Surveys; *The Tailored Design Method. 2nd Edition.* New York, Wiley.
21) Dourish, P. (2006). Implications for Design. *CHI,* Montreal, Quebec, ACM PRESS. p541-50.
22) Dourish, P., Grinter, R., Delgado de la Flor, J., and Joseph, M. (2004). Security in the Wild: User Strategies for Managing Security as an Everyday, Practical Problem. *Personal and Ubiquitous Computing*, **8**(6), p391-401.
23) Egido, C. and Patterson, J. 1988. Pictures and category labels as navigational aids for catalog browsing. *In Proceedings of CHI '88.* ACM Press, New York, NY, 127-132.Emmons, 1996
24) Faulkner, W. (2000). "Dualisms, Hierarchies and Gender in Engineering." *Social Studies of Science* **30**(5): p759-92.
25) Faulkner, W. (2000). "The Power *and* the Pleasure? A Research agenda for "Making Gender Stick" to Engineers." *Science, Technology and Human Values* **25**(1): p87-119.
26) Faulkner, W. (2001). "The Technology Question in Feminism: A View from Feminist Technology Studies." Women's Studies International Forum **24**(1): p79-95.
27) Fischer, C. S. (1992). *America Calling: A Social History of the Telephone. Berkeley,* Ca, U of CA Press, Berkeley.
28) Franks (2002). "Feminisms and Cross-ideological Feminist Social Research: Standpoint, Situatedness and Positionality – Developing Cross-ideological Feminist Research." *Journal of International Women's Studies* **3**(2).
29) Friedman, Batya (1996). Value-sensitive design, *interactions,* v.3 n.6, p.16-23.
30) Frissen, V. (1985). Gender is Calling: Uses of the Telephone. *The Gender-Technology Relation; Contemporary Theory and Research.* K. Grint, and Gill, R. London, Taylor and Francis.

31) Gaver, B., Dunne T, Pacenti E (1999). "Cultural probes." *Interactions* **1**: p21–29
32) Geertz, C. (1977). Deep Play: Notes on the Balinese Cockfight. *The Interpretation of Cultures.*
33) Gershuny, J.K. (1983) Social Innovation and the Division of Labour. Oxford: Oxford U P.
34) Giddens, A. (1979 (reprint 1994)). Agency, Structure. *Central Problems in Social Theory*, U of California P**.** p49-95.
35) Goffman, E. (1959). The Presentation of Self in Everyday Life, Anchor.
36) Grint, K., and Gill, R. (1985). *The Gender-Technology Relation; Contemporary Theory and Research.* London, Taylor and Francis.
37) Grinter, Edwards, Newman, & Ducheneaut, (2005). The Work to Make the Home Network Work. *Proceedings of the ninth conference on European Conference on Computer Supported Cooperative Work*. p 469 - 488.
38) Hamill, L. (2001). Orange-At-Home project, http://www.surrey.ac.uk/dwrc/orange.html
39) Hapnes, T., and K. H. Sørenson (1995). Competition and Collaboration in Male Shaping of Computing: A Study of Norwegian Hacker Culture. *The Gender Technology Relation; Contemporary Theory and Research.* K. Grint, and Gill, R. London, Taylor & Francis.
40) Harding, S. (1986). *The Science Question in Feminism.* Ithaca, NY, Cornell U P.
41) Haring, K. (2003). "The "Freer Men" of Ham Radio: How a Technical Hobby Provided Social and Spatial Distance." *Technology and Culture* **44**(4): p734-61.
42) Hartsock, N. (1983). The Feminist Standpoint: Developing the Ground for a Specifically Feminist Historical Materialism. In Harding and Hintikka, eds. *Discovering Reality,* 283-310.
43) Huff, C. (2002). "Gender, Software Design, and Occupational Equity." *SIGCSE* **34**(2): 112-115.
44) Hyun Chung, K., Kyoung Soon Oh, Cheong Hyun Lee, Jae Hyun Park, Sunae Kim, Soon Hee Kim, Beth Loring, and Chris Hass (2003). A user-centered approach to designing home network interfaces. *CHI 2003*. p648-9.
45) Intille, S. S., K. Larson, J. S. Beaudin, J. Nawyn, E. Munguia Tapia, and P. Kaushik. (2005). A living laboratory for the design and evaluation of ubiquitous computing technologies. *Extended Abstracts of the 2005 Conference on Human Factors in Computing Systems*, New York, NY, ACM Press.
46) Jowell, R., Brook L, Prior G, Taylor B (eds) (1992). *British social attitudes: the 9th report. .* Aldershot, Dartmouth Publishing.

47) Kvande, E. (1999). "'In the Belly of the Beast;' Constructing Femininities in Engineering Organizations " *The European Journal of Women's Studies* **6**: p305-328.
48) Kelleher, Pausch, & Kiesler (2007). Storytelling Alice motivates middle school girls to learn computer programming. *Proceedings of the SIGCHI conference on Human factors in computing systems.* p1455 - 1464
49) Kiesler, S., B. Zdaniuk, V. Lundmark, and R. Kraut. (2002). "Troubles With the Internet: The Dynamics of Help at Home." *Human-Computer Interaction* **15**: p323-51.
50) Kleif, T., and W. Faulkner "Boys and their Toys: Men's Pleasure in Technology."
51) Kidd, C. D., R. Orr R, G.D. Abowd, C.G. Atkeson, I.A. Essa, B. MacIntyre, E. Mynatt E, T.E. Starner, and W. Newstetter (1999). The Aware Home: A Living Laboratory for Ubiquitous Computing Research. Proceedings of the 2nd International Workshop on Cooperative Buildings. (CoBuild 99).
52) Kraut, R., Scherlis W, Mukhopadhyay T, Manning J, and Kiesler S (1996). "The HomeNet field trial of residential internet services." *Communications of the ACM* **39**: p55 – 65.
53) Lally, E. (2002). *At Home with Computers.* Oxford, Berg.
54) Livingstone, S. (1992). The meaning of domestic technologies: a personal construct analysis of familial gender relations. *Information and Communication Technologies in the Home.* Routledge, New York.
55) Lofland, J. and Lofland, L. 1994. Analyzing Social Settings: A Guide to Qualitative Observation and Analysis. Wadsworth.
56) Logan, R. L., Augaitis, S., Miller, R.H., and Wehmer, K. (1995). " Living Room Culture- An Anthropological Study of Television Usage Behaviors." *Proc. Human Factors and Ergonomics Society 39th Annual Meeting.* p326-330.
57) MacCormack, C., and Marilyn Strathern (1989). *Nature, Culture and Gender*. Cambridge, Cambridge UP.
58) MacKinnion (1987). Difference and Domination: On Sex Discrimination. *Feminism Unmodified; Discourses on Life and Law*. Cambridge, Harvard UP. p32-45.
59) Mateas, M., Salvador, T., Scholtz, J., and Sorensen, D. (1996). *Engineering ethnography in the home.* CHI 96.
60) Maushart, S. (2001). *Wifework; What Marriage Really Means for Women*. New York, NY, Bloomsbury.
61) Moi, Torril (1999). *What is Woman?* Oxford, Oxford UP.
62) Mozer, M. (1998). The Neural Network House: An Environment that Adapts to its Inhabitants. *AAAI*: p110-14.

63) Newman, Mark, Jana Z. Sedivy, W. Keith Edwards, Trevor F Smith, Karen Marcelo, Christine M. Neuwirth, Jason I. Hong, and Shahram Izadi (2002). "Designing for Serendipity: Supporting End-User Configurations of Ubiquitous Computing Environments." Proceedings of the Conference on Designing Interactive Systems (DIS 2002). London, UK. June 25-28, 2002.
64) Nielsen & Curtis, (1995). "Applying discount usability engineering. ." *IEEE Software* **12**: p98 – 100.
65) O'Brien & Rodden, O'Brien, a. T., Rodden, (1997). "Interactive Systems in Domestic Environments." *Proc. of DIS*: p247-259.
66) Ortner, S. B. (1974). "Is Female to Male as Nature is to Culture." *Women, Culture and Society:* 67-88.
67) Ortner, S. (1995). Ethnography Among the Newark; The Class of '58 Weequahic High School. *Naturalizing Power; Essays in Feminist Cultural Analysis* S. J. Yanagisako, and C. Delaney. New York, Routeledge. New York, Routeledge.
68) Ortner, S. B. (1995). *New Jersey Dreaming: Capital, Culture, and the Class of '58.* Durkham, Duke UP.
69) Riviere, Joan. (1929). Womanliness as Masquerade. *International Journal of Psycho-Analysis* **9**: 303-313.
70) Rode, J. A., Eleanor F. Toye, and Alan F. Blackwell (2004). "The Domestic Economy: a Broader Unit of Analysis for End User Programming". *CHI,* Portland, OR, ACM PRESS. p161-176.
71) Rode, J. A., Eleanor F. Toye, and Alan F. Blackwell (2004). "The Fuzzy Felt Ethnography- understanding the programming patterns of domestic appliances." *Personal and Ubiquitous Computing* **8**: p161-176.
72) Rowe, M. B. (1978). *Teaching Science as Continuous Inquiry a Basic*. New York, NY, McGraw Hill.
73) Scott, J. W. (1988). "Deconstructing Equality-versus-Difference: Or, the Uses of Poststructuralist Theory for Feminism." *Feminist Studies* **14**(1): p32-50.
74) Spender, D (1995). Nattering on the Net; Women Power and Cyberspace. Melbourne, Spinfex.
75) Spigel, L. (1992). Make Room for TV: Television and the Family Ideal in Postwar America. Chicago, U Chicago P.
76) Spigel, L. (2005). "Designing the Smart House; Posthuman Domesticity and Conspicuous Production." *European Journal of Cultural Studies* **8**(4): 403-26.
77) Strathern, M. (1980). No Nature, No Culture: The Hagen Case. *Nature, Culture and Gender*. C. MacCormack, and Marilyn Strathern. Cambridge, Cambridge UP. 174-219.
78) Strasser, S. (2000). *Never Done.* Holt Paperbacks; New York.

79) Strauss, A. and J. Corbin. 1998. Basics of Qualitative Research: Grounded Theory *Procedures and Techniques*. (Second Edition) Newbury Park, CA: Sage Publications.
80) Tong, R. P. (1998). Feminist Thought: A More Comprehensive Introduction. Boulder, Westview P.
81) Truong, K. N., Elaine M. Huang, and Gregory D. Abowd (2004). CAMP: A Magnetic Poetry Interface for End-User Programming of Capture Applications for the Home. *Ubicomp.* p143-160.
82) Turkel, S. 1988. "Computational Reticence: Why Women fear the Intimate Machine", In Kramarae, C. (ed.) *Technology and Women's voices*. NY, Routeledge and Kegan Paul.
83) Turkle, S., and Seymour Papert (1990). "Epistemological Pluralism: Styles and Voices within the Computer Culture." *Signs* **16**(1): p128-57.
84) van de Sluis, R., B. Eggen, J. Jansen, and H. Kohar (2001). User Interface for an in-home Environment. Interact, Tokyo, Japan, IOS Press.
85) Wajcman, J. (1992). Feminist Theories of technology, Paper presented at workshop on The Gender- Technology Relation, CRICT, Brunell University 16-17 Sep.
86) Wacjman, J (2007). From Women and Technology to Gendered Technoscience. *Information*, *Communication and Society.* **10**:3, 287-98.
87) Webley, P., Burgoyne, C., Lea, S., and Young, B. (2001). Economic Behavior in the Family. *The Economic Psychology of Everyday Life***:** p75-98.
88) West, C., and Sarah Fenstermaker (1995). "Doing Difference." *Gender, and Society* **9**(1): p8-37.
89) Young, I. M. (2005). *On Female Body Experience: "Throwing like a Girl" and Other Essays.* Oxford, UK, Oxford U P.