SUPPORTING ADVICE SHARING FOR TECHNICAL PROBLEMS IN RESIDENTIAL SETTINGS

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SUPPORTING ADVICE SHARING FOR TECHNICAL PROBLEMS IN RESIDENTIAL SETTINGS

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Just because something doesn't do what you planned it to do doesn't mean it's useless.

– Thomas Edison

To PD and BB. You were always there for me.

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SUMMARY

Visions of future computing in residential settings often come with assumptions of seamless, well-functioning, properly configured devices and network connectivity. In the near term, however, processes of setup, maintenance, and troubleshooting are fraught with difficulties; householders regularly report these tasks as confusing, frustrating, and unpleasant. Prior attempts at reducing technical complexity in homes have largely focused on automating configuration tasks, automatically detecting and correcting improper configurations, and offering intelligent interfaces for providing help to users. Little research, however, has examined how we might be able to support *human-to-human* communication around complex technologies at home.

In this dissertation, I investigated the sources of and ways that people grapple with technical complexity in the home, and built tools to support people in their endeavors to overcome these difficulties. I examined the problem of home technology complexity not just from a technology- or usability- centered perspective, but through a socio-technical approach that addresses factors such as routines, rituals, and knowledge disparities between people who interact with residential computing infrastructures.

In particular, a growing number of people rely on family and friends for help with computing problems. Yet these support practices are largely ignored in the design of systems for supporting users who have computing questions or problems. How do we handle computer support for cases in which people either cannot or choose not to have access to a professional? How can we support people in learning more about how the possibilities of what their applications, devices, and combinations of devices can do, as well as coping with situations in which technology does not function as expected? How can we leverage family and friends as a knowledgeable source of information?

In my research, I conducted a series of empirical studies examining both the sources of digital complexity in residential settings well as how people cope with these complexities. Grounded in this fieldwork, I designed a technology probe called Tech Clips, which facilitates the sharing of technology-related information by and for people within one's social network, then conducted a study in which ten families used the software for an extended period, while also simultaneously completing a series of common computing setup and maintenance tasks. Based on the results of this study, I provide both a rich description of home technology usage and maintenance practices, as well as implications for the design of software systems that facilitate help giving between family and friends.

The contributions of this research include (1) empirical studies of how lay people understand and cope with vexing technology problems in environments lacking technical experts; (2) the development of a software system to facilitate technical advice sharing; (3) deployment of this system in real-world settings; and (4) recommendations for the design of future tools for facilitating technical help-giving between family and friends.

1. INTRODUCTION

Residential computing infrastructure offers a number of difficulties because of the generative[1] nature of the technologies in homes; in particular, devices can be combined in myriad ways, there is no single user interface for interaction with interconnected systems in the home, and householders may have incorrect mental models of component functionality or interconnectivity. Additionally, there are a number of stakeholders involved with the upkeep of residential computing infrastructures, and these stakeholders are not well coordinated. To cope with these difficulties, householders may rely on perceived technically knowledgeable people within their social networks for technology help. This reliance may be for a number of reasons, including convenience, cost, and greater trust and comfort with receiving technical support from a known person than a stranger. This help can come in a number of forms, including setting up or troubleshooting devices, teaching a help-seeker, and sharing advice. Yet what are the barriers and opportunities associated with participating in informal help channels?

This dissertation explores the sources of confusion and difficulty associated with residential computing infrastructures, mechanisms used by householders for coping with technology problems in residential settings, and the design and deployment of a technology probe intended to elucidate information about the dynamics of technological advice sharing over informal channels. As a lens for analyzing my work, I use the constructs of *'face' (Goffman 1959, Brown and Levinson 1987)* and *role theory* (Biddle 1986). These theories examine how common social roles one plays in everyday life (e.g. as a parent, firefighter, sibling, database administrator) influence one's interactions with

[1] Generative technologies are those that invite the user to tinker and repurpose.

others. In particular, I am interested in understanding more how face and social roles impact participation in informal technical help channels.

The early chapters of this thesis examine technical and social reasons that householders have difficulties with residential computing infrastructures. In Chapter 3, I examine how technological properties of computing infrastructures in the home—such as householder perceptions of network infrastructure, security, and generativity—affect maintenance and support practices. In Chapter 4, I present the results of a study that examine how face and social roles strongly mediate participation in informal help channels. With knowledge of these social roles—of things that are opportunities and barriers to participating in support practices—the later parts of this thesis examine how these roles are operationalized in practice. I also look at the role that software can have in enhancing these practices (e.g. by reducing burden, increasing confidence, and increasing effectiveness of participation in the upkeep of residential computing infrastructures.) Based on what we know both about the technological landscape of the home, as well as the social dynamics of participation in informal helping practices, I finally examine the roles that collaborative software systems can play in home-based technical support. With these above listed considerations in mind, I present the following thesis statement:

> *Software systems that facilitate technical advice sharing among groups of people who have communal relationships can assist help-seekers and help-givers in overcoming difficulties related to setup and maintenance of residential computing infrastructures. For help-seekers, these systems can increase their confidence about their computing abilities (hence supporting 'positive face'). For help-givers, these tools can reduce perceived time and effort burden of participating in technical support activities (hence supporting 'negative face').*

In particular, I address five research questions, which include:

- ***Q1: What are the sources of confusion and difficulty for householders setting up, maintaining, and using residential computing infrastructures?***

- ***Q2: What mechanisms are householders using to cope with these difficulties and what are their motivations for choosing these mechanisms?***

To answer Q1 and Q2, I completed an analysis of home network infrastructures that examines how the design of network protocols currently used in homes leads to user experience challenges (Shehan and Edwards 2007). Secondly, I conducted empirical fieldwork that addresses these questions from multiple angles. To understand householder mental models of their residential computing infrastructures, I analyzed householder-drawn sketches of their understandings of their home networks (Poole *et al.* 2008) and conducted a qualitative study analyzing recordings of calls made to a network hardware manufacturer's helpline (Poole *et al.* 2009b). All of this work is discussed in Chapter 3. Additionally, to understand common problems experienced by householders, I conducted an interview-based study of participants in residential help-seeking and help-giving (Poole *et al.* 2009a). This study is discussed in more detail in Chapter 4, and suggested that for many people, family and friends are important resources for coping with digital complexity in residential settings. It also suggested that many people seeking help may have problems with self-efficacy related to completing computing tasks, and that help providers may feel like the time and effort of providing this informal help is unreasonable, but a necessary part of their social role as a family member or friend. Prior research on help-seeking practices, or on the design of software help systems, does not account for this common type of help giving, nor do we know how to design software systems that supplement, mediate, or scaffold help giving through informal channels. Thus, with those considerations in mind, my remaining research questions are as follows:

RQ3: How does the presence of a tool with features grounded in the empirical research of RQ1 and RQ2 change the dynamics of domestic help provision? In particular:

- ***RQ3.1: To what extent can software tools for giving and receiving help within one's social network help people become effective at completing home computing application tasks, and home networking setup and maintenance tasks?***

- ***RQ3.2: To what extent can software tools for giving and receiving help within one's social network help people become more confident about using and maintaining residential computing infrastructures?***

- ***RQ3.3: To what extent can software tools for giving and receiving help within one's social network decrease subjective perceptions of time and effort cost of providing technical help?***

To answer this set of questions, I conducted a second study, which I will refer to as the *Family Facilitation Study*. In the *Family Facilitation Study*, 10 families participated in a multi-week study in which they set up, configured, used, and helped their family and friends with learning more about common home electronics and information technologies that prior studies have shown to be problematic. As part of this study, the participants installed and used a piece of software that allowed them to store and share bits of computer-related information (such as troubleshooting info, how-tos, and reminders) with family members and close friends. The design of this study is described more fully in Chapter 5, and the results of the study are described in Chapters 6-8. Conclusions are discussed in Chapter 9.

2. RELATED WORK

Help documentation is often ignored both by users as well as technology developers (Rettig 1991); when technology users resort to documentation, they tend to "skip, scan, and skim" (Mehlenbacher 2003). Often documentation is both too complicated, as well as too detailed. Written documentation is often an afterthought in the technology development process, and typically focuses on features rather than procedural "how-to" advice (Carroll *et al.* 1987, Mehlenbacher 2003). When documentation is insufficient or ignored, in what ways do computer users go about seeking help?

Literature in HCI and CSCW offers three major branches of research on help seeking. One branch focuses on building systems for providing help more efficiently and effectively. Work in this genre typically makes an implicit assumption that help is a one-time transaction of information rather than an ongoing, longitudinal activity. A second genre considers help giving in large, distributed settings, such as the Internet or large corporations. The third branch of work, primarily qualitative in nature, examines long-term technical helping practices in residential settings, but does not provide any special attention to system building.

In my own work, I aim to bridge the gap between these approaches. Given what we know about the dynamics of families, where—if any place—is there a role for software that assists with the provision of technical help in residential settings? In the following sections, I describe this prior work, beginning with the system-building approaches that consider help as a one-time transaction, then transitioning to a discussion of distributed help, and finally discussing ethnographic, longitudinal studies of home computing usage and technical help in residential settings.

2.1. Help as a User Interface Problem

When help is cast as a user interface problem, the resulting research focuses on building novel user interface components to provide previously unusable help information in a more human-centered manner. One early (and now pervasive) form of user assistance with GUI elements is Balloon Help, in which a user hovers his or her mouse over a GUI element, and a short piece of relevant help information appears in an overlaid "balloon" on the screen (Farkas 1993). More recently, Kelleher and Pausch created the Stencils system, which created visual overlays for assisting users in directing their attention to important areas of a user interface (e.g. in a tutorial or help system (Kelleher and Pausch 2005). Huang and Twidale created Graphstract (Huang and Twidale 2007), a system that combines use of abstracted screenshots with Carroll et al.'s minimal manuals concept (Carroll *et al.* 1987)to convey procedural information about computing tasks through short graphical snippets. Finally, using computer vision techniques, Yeh et al. created a system in which users may take screenshots of GUI elements, and then search for information directly related to the graphical element of interest (Yeh *et al.* 2008). While these systems provide novel user interfaces for directing people to relevant help information, they do not work well in situations where users do not have a well-formed question in mind, or need help with *multi-device* environments. In the case of reasoning about network troubles, for instance, deducing whether help is relevant is a more complicated matter than having one's eyes directed to an overlay on a screen.

2.2. Help as Communication over Distributed Channels

Given CSCW's history of studying workplace collaborations—often between people who are physically distant or don't know each other—a body of research focuses on the development of knowledge management systems that assist with locating experts who can provide more information about topics of interest, and archiving the collective knowledge of these experts

(Grudin 2006). For example, AnswerGarden is a question and answer system that made knowledge held by members of an organization available to all, while also identifying subject matter experts. The system provided a tree of questions and answers for users. If the answer existed within the system, then the help seeker would be guided to it. If the answer did not exist, the seeker would be put in contact with the appropriate expert, who would email an answer and at his or her discretion insert the question back into the Answer Garden database for future queries (Ackerman 1998). Answer Garden, however, divided its users into two camps: experts or novices. However, as the authors note in the AnswerGarden2 paper, expertise is not so sharply divided in the real world; rather, different people have different types of expertise. AnswerGarden2, drawing on the original Answer Garden system, provided a mechanism for finding specialized help, particularly in distributed scientific communities; the system "narrow-casts" questions to appropriate potential helpers within an organization, and allowed more people within the organization to contribute expertise to the system (Ackerman and McDonald 1996). These systems provide some inspiration for how we might provide technical help at home; for instance, providing permanent documentation of common problems is likely helpful for home settings. Unlike organizational settings, however, identifying *who* an expert may be is likely far less important.

Outside of workplace settings, other research in HCI and CSCW focuses on a different sort of distributed help seeking: finding technical help online. This help may be shared in the form of question-and answer systems, general purpose bulletin boards, "how to" documents (Torrey *et al.* 2007a), FAQs (Halverson et. al., 2004), or tutorials (Perkel and Herr-Stephenson 2008). Help provision over the internet has been studied in a number of niche domains, including open source software development (Lakhani and von Hippel 2003, Singh and Twidale 2008), computer programming (Adamic 2008), gadget building and crafting (Torrey *et al.* 2007b), and fixing consumer electronics (Yardi and Poole 2009). With the exception of Yardi and Poole's consumer

electronics study, most of these studies focus on supporting the interests of enthusiastic hobbyists. The population that I am studying, in contrast, while distributed over distance, may not be enthusiastic about the topic at hand. Furthermore, they are much more likely to have established offline relationships. It is not likely that they are communicating primarily to discuss information technologies in their home; technical help provision is instead part of a long-term relationship wholly unrelated to information technologies in one's home.

Furthermore, these communities, often have hundreds or thousands of participants, and face vexing problems of scale. Identifying expert users and separating quality content from irrelevant content become challenges (Zhang *et al.* 2007, Adamic 2008, Harper *et al.* 2009, Nam *et al.* 2009). In contrast, given smaller help communities of family and friends, such as I am studying, these scale-related problems may be less important. In addition, this online help research does not focus on the bridge between help seeking *online* and help seeking from offline resources, particularly family and friends who may be readily available for questions.

2.3. Studies of Home Computing Practices and Help-Seeking

In the remainder of this chapter, I discuss related work focused on how people use computing within the home, as well as technological help seeking that occurs residential settings. This research is predominantly qualitative in nature, examined long-term computer support practices, and did not heed any special attention to the role that software systems may play in the help-giving process.

2.3.1. Early Studies of Home Computing Practices and Help Seeking

As computing entered the homes of electronics hobbyists and office workers in the 1970s and early 1980s, researchers began studying the "home computer revolution." Dickerson and Gentry studied the characteristics of early computer adopters (Dickerson and Gentry 1983). Despite being

a *revolution* within the home, the early computer had difficulties finding a place in the household. Dickerson and Gentry described early adopters not only as middle-aged, more highly educated, with more income and more experience with similar technologies but also as "logical introverts." By that phrase, they mean "*homebodies who are interested neither in the arts nor in innovations that would enhance their ability to communicate.*" Venkatesh and Vilari continued investigating the early uses of home computers in America (Venkatesh and Vitalari 1987, Venkatesh 1996). This early work found families were confused about how to integrate computers into the "social context of the household," starting first with *where* to put the computer in the home.

Computers, unlike VCRs, microwaves, or vacuum cleaners, didn't meet specific, well-defined need of most households (Venkatesh 1996). Given the limited availability of home-specific software packages and low computer literacy among the public, there were not many things most people could envision *doing* with a home computer. Thus these early home computers, used predominantly by males, were used for either for hobbyist purposes, or for telecommuting and otherwise bringing office work into the home environment. It is noteworthy, however, that these early computers were envisioned as ways to enhance the education of children. However once actually in the home, very few people actually *used* educational applications for children; Venkatesh speculates this lack of adoption is due to the relatively low quality of available educational software at the time (Venkatesh and Vitalari 1987, Venkatesh 1996).

In the 1990s, however, the character of computer usage in the home changed. More software packages were tailored for home use, the public became more computer literate, and the Internet began its rise to popularity. No longer were computers used merely for office work or as the hobby of "logical introverts." Computers became tools for keeping track of household finances, leisure, shopping, communication, and educational development.

Early studies of computer help at home focused on the experiences of Americans trying dial-up Internet for the first time. Researchers at US West (Franzke and McClard 1996) and Carnegie-Mellon University (Kiesler et al. 2000) tracked the experiences of families new to the Internet through two studies, which I will refer to as the US West and HomeNet studies. The US West study followed 50 families in Minnesota who became Internet users as a part of a larger initiative to support parent-teacher communication online (Franzke and McClard 1996). The HomeNet study provided 93 Pittsburgh-area families with a computer, modem, Internet service, training, and access to a university student-staffed help desk for a year.

In both of these early studies, many families were eager to be on the Internet, but this excitement was tempered by regular troubles with computers and connectivity, particularly when it came to installation processes or troubleshooting with a technician. (A particular artifact of this early period of home Internet use is that to troubleshoot dial-up connection problems, callers had to hang up the phone in order to try fixes because they typically only had one phone line in the home shared for voice and data). Furthermore, in the US West study (and likely also in the HomeNet study), the ISP infrastructure at the time was not well-developed, so there were problems with the Internet that were the fault of the ISP, but users didn't recognize that the fault was not their own, leading to more frustration.

Parents were cast as more timid in using and fixing problems with the Internet; the US West researchers reported that parents relied more on official resources such as help lines and local training sessions; on the other hand, the HomeNet researchers found somewhat conflicting results. In their study, they found that the most technically inclined person in the house—who was typically a teenager—would be the person who called the help desk and serve as a conduit between the

home and the technicians.[2] However, calling the help desk was not a first step in solving problems; although 89% of HomeNet participants called the helpdesk at least once over the course of a year, they were far more likely to seek help from within the home first.

Further, within each family, a "guru" for dealing with computer issues emerged; frequently this guru was a teenager or the person using the Internet the most. Teens were reported to try tinkering as well as turning to their social network to fix problems. However, teens would also monopolize the computer; parents were left to use the computer late at night, when help desks were closed, and when their (more knowledgeable) children were asleep (Franzke and McClard 1996). The role reversal of children-as-experts and parents-as-novices was a source of discomfort in some families; parents reported being reluctant to ask for help after having negative experiences when seeking help from their teenaged kids.

As described in the HomeNet study, the guru (whether teenager or otherwise) mediated calls to the external help desk and customized the family computer. This guru could also be a source of tension in the home, given that the traditional roles of a parent as an expert and a child not being an expert were frequently reversed in this situation.

2.3.2. **The Rise of Home Broadband and Device Mobility**

In the time since these early studies of dial-up Internet practices, the landscape of Internet use in the United States has changed. Today, 78% of Americans use the Internet regularly, either through a home broadband connection, connectivity available at a "third place" such as a coffee house or library, or a cellular network mobile device. Of particular note is the increase of broadband

[2] A reason for this difference might have to do with who is paying the bills, as well as who was answering at the other end of the help desk line. In the US West study, parents were likely listed as the subscribers to accounts, and for that reason parents may have been more likely to call an ISP-hosted help desk. The helpdesk in the HomeNet study, however, was staffed by Carnegie Mellon undergraduate students, and may have been perceived as a more egalitarian resource available to people who weren't the primary subscriber to the account.

adoption in American households; at least 67% of Americans now have broadband access available in their homes (Horrigan 2010)

The shift to high-speed Internet connectivity at home also led to shifts in how devices are configured and maintained in American homes. Rather than having contention over sharing a single computer, families have, in many cases, shifted to owning *multiple* machines, many of which are portable devices that encourage the adoption of wireless connectivity (Woodruff *et al.* 2007). As the price of computer hardware has decreased, it may also be more affordable to have multiple computers in a home. Moreover, as these newer, faster computers are purchased, older ones may be repurposed (e.g. by becoming children's computers). Thus, more homes are relying on networks within the home in order to provide Internet connectivity simultaneously to computers and other consumer electronics, as well as to share resources such as printers and media.

As the complexity of the residential computing infrastructures increase, the difficulties of configuring, upgrading, and troubleshooting *also* increase. Just like in the US West and HomeNet studies of dial-up practices, more recent research focused on networked residential computing infrastructures finds families are still faced with vexing problems related to installation and troubleshooting (Grinter *et al.* 2005, Bly *et al.* 2006, Chetty *et al.* 2007, McDonald *et al.* 2008, Tolmie *et al.* 2010).

2.3.3. **Help Within the Home: Rethinking the Role of the Guru**

The HomeNet study described teenagers as the most frequent sources of computer expertise in the home; teens customized the computer, and took responsibility for fixing problems involving calling an external help desk(Kiesler *et al.* 2000). Is this characterization of help at home still accurate? Grinter et al. (Grinter *et al.* 2005) characterized the work that is required to setup and maintain networked computing within the home, but studied homes without children. Among their

participants, a pattern emerged about network maintenance practices; as in the earlier HomeNet studies, one person in the home typically became a guru who would help other (sometimes less technically inclined) occupants. Others in the home—mere "consumers" of the technology—were disempowered when the network malfunctioned. When seeking help from parties outside the home, participants reported confusion about *whom* to go to for help; most home networks are comprised of hardware and software from different vendors, and may require multiple service provides to function. Bly et al. also echo this finding in their study of householders troubleshooting networking products (Bly *et al.* 2006) . In contrast to the HomeNet study, Chetty et al., who studied network caretaking practices in homes with children, found that the guru role in households with children does not necessarily fall upon teenage kids but to the most technically knowledgeable individual in the house (Chetty *et al.* 2007).

Is this depiction of the "lone guru" in the home accurate, however? Newer research has suggested that practices surrounding setup, use, and maintenance of the network are highly collaborative. These practices require collaborations both between people *within* a household as well as between those within the household and those who live elsewhere (Grinter *et al.* 2005, Tolmie *et al.* 2007, Grinter *et al.* 2009).

Even within the home, technical maintenance practices, upon additional scrutiny, may more closely represent a "domestic economy," in which family members specialize in certain aspects of home computing, trading expertise as necessary (Rode *et al.* 2004). For instance, one family member may know quite a bit about spreadsheets or audiovisual equipment, but little about network configurations. Thus, help is not always unidirectional, provided by a single "guru." A family member may both simultaneously ask for help as well as provide help; this suggests that systems in support of home help practices require sufficient flexibility to support a home's domestic economy.

Moreover, even for individual tasks such as troubleshooting network connectivity, there may be more than one person involved in resolving problems and maintaining infrastructures. My own work (Poole *et al.* 2008) identified additional maintenance roles within the home, including the "assister" who may have some technical knowledge and help with troubleshooting to a certain degree, and "consumers" who use the network but are not actively involved in troubleshooting.

2.3.4. **Local Knowledge and the Challenges of Seeking Technical Help from Outsiders**

Beyond seeking help within the home, it is inevitable that householders may need to interact with outside technicians, an experience that can bring in much needed technical knowledge, but also lead to other problems. For instance, in Grinter et al.'s study reporting retrospective householder accounts of encounters with professional technicians, (Grinter *et al.* 2005), professional help was seen at times as a *source of problems.* Householders reported that when professional technicians visited the home to setup or fix equipment on the home network, these technicians were unaware of local customizations or usage patterns of the network; the scripts these technicians followed often underestimated the complexity of the home network, breaking existing configurations. This local, embedded knowledge of structure and uses of the home network reflects the technical embodiment of routines in the home, as described by Crabtree and Rodden (Crabtree and Rodden 2004). The day-to-day "digital housekeeping" practices described by Tolmie et al. reflect these customizations (Tolmie *et al.* 2007), and suggest that householders may have difficulties expressing "local knowledge" to outside helpers (e.g., applications that can be removed without trouble, and those that cannot).

In another exploration of domestic networking, Chetty et al. describe the relationship between the infrastructure of the home and the evolution of the home network (Chetty *et al.* 2007), using an analysis based on Brand (Brand 1994). This work underscores how the built

environment can pose limitations on how home networks are setup, maintained, and upgraded. Work by Woodruff et al., has similarly examined how the physical plant of the home influenced routines of technology use, in this case, patterns of laptop use within the home (Woodruff *et al.* 2007). Poole et al. also note how physical infrastructures of the home can negatively impact phone-based network troubleshooting (Poole *et al.* 2009b). Outside helpers such as professional technicians may not have knowledge of the unique characteristics of the physical environment of homes that may influence user experiences with respect to networked technology. For all of these reasons, there may be advantages to further supporting "informal" help provided by family and close friends who are already more familiar with the routines and practices of a given household.

2.4. **Summary**

Prior work examined how computing technologies are maintained within residential settings. There is also ample previous work examining solutions to pragmatic difficulties of seeking technical help using a computer, including finding better ways to distinguish quality from irrelevant content, as well as developing novel UI components that put help information in easily accessible and understandable locations.

There is a gap, however, between research of help practices in-situ and research in help system-building work, particularly in residential settings. A limited body of systems-oriented work takes a socio-technical perspective, for example, by examining technical help as a problem of expertise location. However, this research has primarily focused on difficulties of providing help in large, distributed organizations or over the Internet.

In my own work, I aim to bridge the gap between the systems building and ethnographic approaches. In the following chapters, I describe a set of studies in which I (1) uncovered methods and motivations currently used when practicing residential technology helping, (2) identified

previously unreported information about the rich technological landscape of residential settings, and (3) identified what roles—if any—that software systems can have in residential technical helping.

3. COMPLEXITY IN RESIDENTIAL COMPUTING ENVIRONMENTS

In this chapter, I provide a framework for understanding complexity in residential computing environments. This framework provides a lens through which to understand and discuss not only the sources of technical complexity in residential computing environments, but also householder responses to these complexities, and opportunities for better supporting people dealing with these challenges. Specifically, I address RQ1*: "What are the sources of confusion and difficulty for householders setting up, maintaining, and using residential computing infrastructures?"*

3.1. Technology Trouble is the Status Quo

Technology use surveys suggest that despite widespread adoption of residential computing infrastructures in American homes, householders experience a myriad of difficulties. Seventeen percent of Americans find everyday usage of residential computing technologies difficult, and of this group, twenty-four percent need usage demonstrations and instructions to operate technologies (Parks Associates 2008). Even for more experienced people, estimates suggest that the average user spends twelve hours per month coping with computer problems (Kelton Research 2007). A recent Pew Foundation report suggests that in the past year, thirty-nine percent of Americans experienced an electronic device failure of some sort, and forty-four percent experienced Internet connectivity problems. Of these people who had device failures and connectivity issues, forty percent reported that they were confused, forty-eight percent were discouraged, and fifty-nine percent were frustrated (Horrigan and Jones 2008).

What, though, is behind these numbers? I argue, based on my own prior research as well as the work of others, that the sources of confusion and difficulty are primarily related to the

following four factors: (1) generativity and statefulness of home computing technologies, (2) the (relative) invisibility of home computing infrastructures, (3) the experiences and expectations of residential computing infrastructure users, and (4) the lack of coordination between stakeholders involved in the upkeep of residential computing infrastructures. In the following sections, I discuss each of these factors in turn.

3.2. Generativity and Statefulness

Home computing devices and their interconnections are *generative* technologies. These technologies are open-ended by design; they invite future tinkering and extension. The range of possible devices—and possible ways to configure and connect those devices—means that every network likely looks different. The networking protocols underlying residential computing infrastructures, too, were designed with generativity in mind. These protocols were originally designed for use by technology researchers and the US military in the midst of the Cold War. Important design goals of these early networked technologies included scalability (the ability to add more machines), extensibility (the ability to develop new sorts of applications upon a common infrastructure), and throughput (the ability to transfer data at adequate speeds) (Hafner 1999).

Despite clear benefits of these design choices, a number of networking researchers, however, have begun to question the appropriateness of many of the design assumptions of these protocols, in light of how network usage has changed in the last 40 years (see, for example (Blumenthal and Clark 2001, Calvert *et al.* 2007)). In the early days of the Internet, all machines on (and people using) the network were generally considered trustworthy; thus no low-level authentication or access control mechanisms were built into the core Internet protocols. Likewise, the basic structures of IP and TCP/IP make no guarantees about quality of service, which can present problems for entertainment applications for streaming audio and video data. Moreover,

because of the guaranteed technical expertise of the people using the predecessors to the Internet, ease-of-use at the network endpoints (actual host computers) was not a primary consideration when designing these protocols (Anderson 2001).

Further, one of the major design goals of this technology was that "specific application level functions usually cannot and preferably should not, be built into the lower levels of the system—the core of the network" (Blumenthal and Clark 2001). This design choice has direct implications on the usability of current home networking technology—though it does have a number of important benefits. Most importantly, it greatly simplifies the design of the core of the network: by limiting the capabilities built into the network itself, the network core can stay relatively simple and fixed, requiring few upgrades while still supporting unlimited extensibility at the edges of the network. This design choice has proved its value repeatedly, as it has allowed a range of applications, for instance such as email and the web, to arise without requiring any changes to the core Internet routing infrastructure or protocols. Adding new functionality only requires agreement at the endpoints (such as the SMTP and HTTP protocols, in the case of email and the web, respectively), not in the network core (Blumenthal and Clark 2001).

A negative consequence of this design choice, however, is that functionality is pushed out of the core of the network to the network edges—in other words, to the components and devices that are installed in users' homes. Because the network design requires that client devices must be correctly configured in order to communicate via the relatively "dumb" network core, someone (or something) must do this configuration. Further, where there is the possibility of configuration, there is the possibility of improper configuration, which in the case of the Internet often prevents client devices from communicating at all. In the Internet model, client devices are largely stateful (since they must maintain their configuration information), complex (since they must be capable of dealing with an open-ended set of application-layer protocols), and managed (since the device must

provide capabilities for someone or something to configure it correctly for the network). Rather than reducing the costs of operating a network, these design choices push the cost and complexity of networking into the hands of the householder.

Note that these usability properties are not determined simply because computer networking is a communication technology. For example, the public circuit-switched telephone network has a radically different infrastructure in which intelligence shifts into the network core and away from the edges. For traditional landline phones, this arrangement provides a simpler user experience. Phones are not stateful devices; they do not "know" their phone numbers, but rather automatically acquire them from the network. Phones are generally simple, single purpose devices that only must understand one simple protocol (and yet, once connected, can place calls to virtually every other number in the world including to devices such as mobile phones that may not have even existed when the wired phone was built). Telephones are not managed (since generally there is nothing that needs to be managed). The user experience of such devices is that a user simply plugs them in and they work (Edwards and Grinter 2001). These examples show how architectural and protocol design decisions can deeply affect usability. In particular, when Internet-style networking protocols are put into the home environment, a number of unforeseen problems appear. Some of the biggest problems of networking in the home environment are related to *statefulness*. Devices must be configured with detailed information that is often difficult to remember (machine name, IP address, components installed on the device, details about patching, etc). While some difficulties related to statefulness are resolved by technologies that automate management of states (e.g. DHCP), not all have been resolved.

Some researchers—from both the networking and the HCI communities—have argued that user experience problems with networked computing in residential settings are in fact inherent in the design of the core Internet technology (such as TCP/IP, and basic end-to-end

architectural principles) that is the basis of current home networking. Ultimately, without wholesale revamping of the Internet architecture and protocols, householders will likely be faced with some degree of network maintenance for the near future.

There have been several commercial and research attempts at providing better tools for network setup and maintenance that work within the existing TCP/IP architecture used in home network technology. Perhaps most widely known are technologies such as the Dynamic Host Configuration Protocol (DHCP) and various discovery protocols (Edwards 2006). These technologies take care of automatically assigning device state, and providing administration-free detection of peer devices, respectively. These "alongside" technologies provide an improved user experience. Further, they work with the existing Internet infrastructure. For example, DHCP-enabled devices can coexist on a network with non-DHCP-enabled devices. There is no need for wholesale buy-in of the technology in order for benefit to accrue.

Research and commercial work has also tackled interface-layer improvements for tasks such as network setup. Most of these introduce a centralized component into the network that has responsibility for configuring clients and maintaining their state; in effect, clients delegate their setup tasks to the centralized component, representing a small-scale shift back to the "intelligence in the network" model. These systems include PARC Network-in-a-Box (Balfanz *et al.* 2004) and Icebox (Yang and Edwards 2007). Other systems provide new interaction techniques for exchanging the configuration information necessary to work within the existing network architecture. These systems, for example, may send information necessary for a laptop to join a wireless network via infrared rather than through manually entered hexadecimal keys. These systems include Microsoft Windows Connect Now[3],Linksys Secure Easy Setup (Elmore *et al.*

[3] http://www.microsoft.com/windowsxp/using/networking/getstarted/windowsconnectnow.mspx

2007), and OSCAR, a system for end-user service composition through community sharing of networked device configuration information (Newman et al. 2008).

After points of initial configuration, there are also two varieties of research and commercial system development aimed at troubleshooting problems on the home network. Wang et al.'s PeerPressure system uses statistical analysis to compare machine configurations and guess which one is broken (Wang et al. 2004). Even this system, however, requires user intervention: "only the user can recognize the sickness and therefore has to be in the loop for these steps." Similarly, HomeMaestro is a system that automatically detects performance bottlenecks in the home; the authors of this study also attempted to understand (very briefly) how people understand performance degradation in the home (Karagiannis et al. 2008). In contrast to technology-centered approaches for improving residential computing setup and maintenance, this dissertation also focuses on identifying opportunities to provide better supports for the social aspects of computer help. That is, in cases where automatically detecting and fixing errors is not possible (or when there is no technical error at all), to what extent can we better support human-to-human communication about residential computing infrastructures? What types of support are most useful in times of technical trouble?

3.3. Invisibility of Infrastructure

Prior research on home computing maintenance practices reveals a consistent source of difficulty and confusion: a number of problems faced by householders are due to the invisibility of many of the technologies (because they are hidden out of sight, little-understood and often forgotten, or because they are wireless, making it harder to understand what is connected). Although these technologies may be invisible to end users, they have consequences for interaction, especially when they are not functioning properly.

Although people may use networked applications such as email or instant messaging, they generally do not see the network itself (apart from physical devices such as routers or cables) during normal, functional use. Networking, like all other infrastructure, is, in the words of Star, "invisible, part of the background for other kinds of work" (Star 1999). Despite this invisibility during normal operation, networks have a direct, tangible impact on how home users interact with the systems built atop them. This impact is most obvious when networked technology malfunctions. In these situations, users must understand and interact with networking in order to correct the problem. Networking also becomes visible when users configure and install new devices, change the behavior or parameters of the network or its components, or remove a device from the network. In all of these cases, the previously invisible infrastructure is foregrounded, and users perceive and experience the infrastructure directly (Bowker 1994).

This problem of invisibility becomes most pronounced when using wireless technologies; in particular, the physical structure of the home itself can affect signal strength, and there is not always a clear mapping between the layout of the house and wireless technology. Nevertheless, even with wired technology, only the physical devices (e.g. computers, routers, modems) and the cables between them are visible. Other layers of the network beyond the physical are not easily inspected. Information such as IP configurations, the flow of packets over the network, or internal states of software are all, in a sense, abstractions. Not only are they complicated to understand, they are also difficult to inspect because of their ephemeral nature. While there are tools that attempt to remove some of this invisibility, for instance by dynamically drawing maps of connectivity and capabilities (cf. Cisco Network Magic[4]), these tools are not in widespread use, nor do they offer a comprehensive answer to the problems of infrastructure invisibility. Recent

[4] http://www.networkmagic.com

research efforts including HomeWatcher (Chetty et al. 2010) and Eden (Yang 2009) aim at assisting home occupants in reasoning about home infrastructures in ways that are both personally meaningful as well as understandable to people without a high degree of technical expertise.

3.4. Experiences and Expectations of Householders

The third source of difficulty involves the experiences and expectations of householders. In particular, a device that is functional in a technical sense may not be perceived as being "working properly" to householders. This gap between technical functionality and socio-technical functionality plays out in three ways in homes; it appears in (1) non-technical requirements of technologies for domestic settings, (2) householder expectations about technology capabilities, and (3) digital dependencies among householders and outside stakeholders.

First, people may have expectations and requirements about how technologies in the home must function that extend *beyond* whether devices are able to communicate to one another and the outside world. For example, device placement is particularly a concern, either due to aesthetics, a desire to monitor the activities of children, or to be located near comfortable furniture or wall power outlets (Grinter *et al.* 2005, Chetty *et al.* 2007, Tolmie *et al.* 2007, Woodruff *et al.* 2007, Aipperspach *et al.* 2008, Poole *et al.* 2008). For a more in depth example of the challenges of device placement as indicated in my own work, please refer to the *Dunwoody Family Case Study* in Chapter 6.

Secondly, householders may have misplaced expectations about the capability of the technologies they are using. For instance, McDonald et al. (2008) conducted a qualitative study of households using networked digital media sharing powered by multiple devices. In their study, they identified several points at which householders can have misunderstandings with respect to digital media sharing. These genres of misunderstandings include device-related misunderstandings

(e.g. what does this device do?), connection-related misunderstandings (e.g. how does this device attach to the network?), communication-related misunderstandings (e.g. what protocols does this device understand?), content format misunderstandings (e.g. which codecs/ formats can my device use?), and content control misunderstandings (e.g. how does the device handle digital rights management?).

Note that in many of these sorts of understandings, there may be nothing technically *wrong* with devices or connectivity in question; it just does not do what the householder thinks it does. This issue of user misunderstandings of device capability is echoed Bly et al.'s study of home network setup as well as in my study of technical support phone calls to home network technical support call centers (Bly *et al.* 2006, Poole *et al.* 2009b). The implication of these misunderstandings is that *no* purely technical solution can exist to address this problem; rather, householders need accurate information about the capabilities of devices, and information about how to achieve their goals in alternative ways, if they have misconceptions about technology capability.

Even with correct understandings of device capabilities, rarely do people keep documentation of the structure of their networks, and given the generativity of computing technologies in residential settings and the division of labor between householders (see Chapter 2 for a more in-depth discussion of division of labor) there are many ways in which devices can be connected and configured. More troubling, however, is that between the occupants of a home, there can also be dependencies of expertise. Previous studies by Grinter et al. (Grinter et al. 2005), Chetty et al. (Chetty et al. 2007) and myself (Poole *et al.* 2008) show that that even in the same household, occupants may have very different conceptualizations of the *same* network. For instance, the sketches below (collected as part of a larger research effort described in (Chetty *et al.* 2007, Poole *et al.* 2008)) show different householders' views of the same home network:

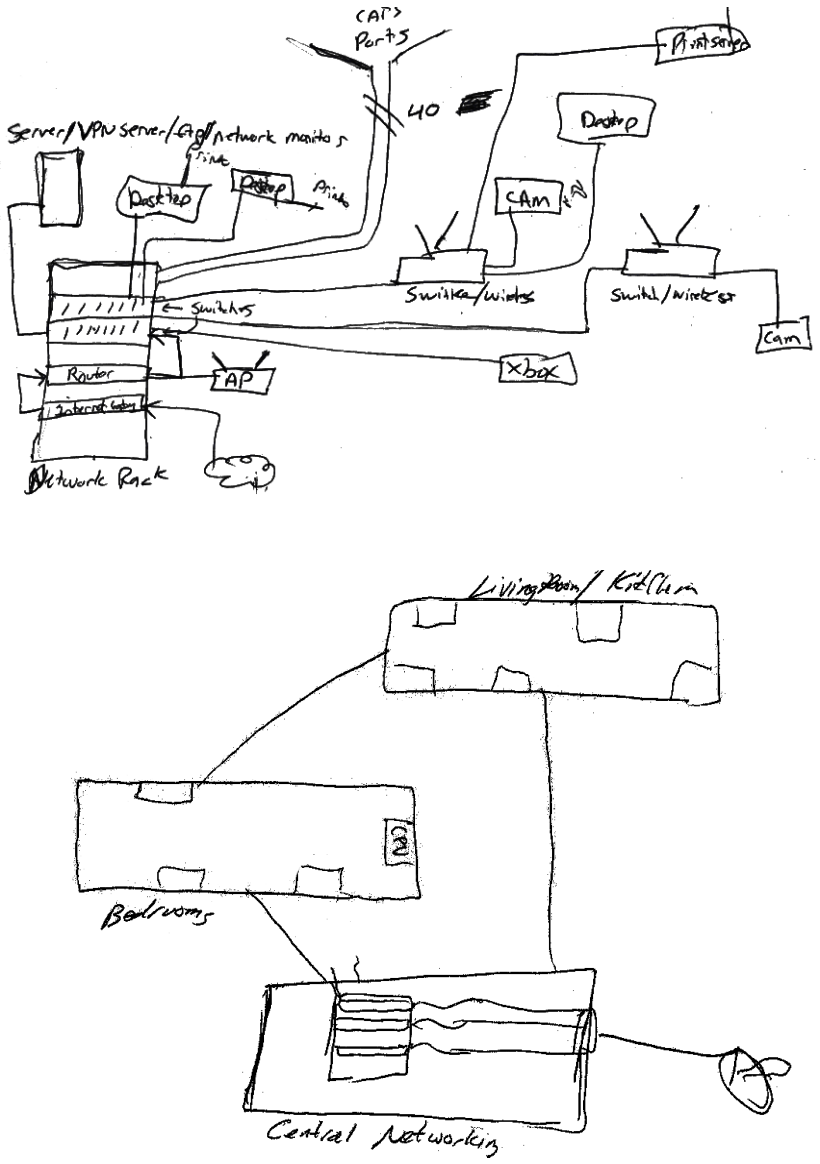

Figure 3.1: Two Different Depictions of the Same Residential Computing Infrastructure

While there were individual differences in how participants chose to sketch their networks, in my study (Poole *et al.* 2008), I saw evidence that householders less engaged with computing maintenance had less detailed and less accurate depictions. Note, however, that even the most expert users did not always draw their networks correctly; some forgot that various devices were

connected to the network. The implication of these digital dependencies is that gaps in knowledge can make setup or maintenance tasks more difficult.

Moreover, when contacting outsiders, another sort of dependency of expertise occurs. In my study of householder calls to technical support lines for wireless router problems (Poole *et al.* 2009b), I found that in these calls, both parties—the householder and the technician—are simultaneously experts and novices. The technician knows about the products offered by the company, and possibly about networking in general, but knows nothing about the particular—and likely deeply personalized—local configuration of the householder's network. Conversely, the householder (possibly—but not for certain) knows situated information of how the home network is configured, the routines of its use, and how it is embedded in the physical and social context of the home, yet may know little to nothing about technical aspects of computing infrastructures.

3.5. **Stakeholder Coordination**

It's reported that half of all calls to broadband technical support lines are, in fact, unrelated to the broadband service (Scherf 2009). Why is it so difficult to know whom to contact when experiencing problems with residential computing infrastructures? In this section, I discuss *stakeholder coordination,* the final difficulty experienced by householders. This difficulty amplifies the others previously discussed.

Residential computing infrastructures require the coordination of multiple stakeholders to function properly. Grinter et al.'s study of home network adoption, for example, indicated that householders regularly paid bills to three to seven different companies to keep their networks working (Grinter et al. 2005). It is not always obvious which company may be the correct contact when problems emerge.

Even on a single *device*, stakeholder coordination is a concern. For example, devices that are on home networks are typically multi-purpose devices with a wide range of software. This software can—and often does—interfere with network connectivity. In my study of calls to a technical support line for wireless router issues (Poole *et al.* 2009b 2009), problems that were thought to be due to faulty wireless network hardware were (in many cases) computer software issues. In a number of calls, there were difficulties related to third party software such as firewalls, virus scanners, and network card management software installed on end-user devices. However, householders often were unable to pinpoint that these pieces of software were the source of trouble—and often did not even know to tell the technician that these pieces of software were installed. In a number of cases, the technicians were unfamiliar with these pieces of software and could not guide the callers to a problem resolution.

Unfortunately, many callers were directed to a *different* stakeholder to resolve their problems. Out of the twenty-one calls analyzed in this study, only three led to a full resolution of the problem; in the remainder, consumers were left with at best a partial solution, and at worst no solution. In most cases, technicians instructed customers to contact yet another call center—for instance, to an ISP or a laptop manufacturer. Some callers gave up on the phone-based process entirely, and terminated calls so that a local person—either a paid technician or a knowledgeable friend—could setup their devices

When a householder is referred to another resource for help, however, he or she does not carry along a record about the steps that have already been tried. Given the number of parties possibly involved with the diagnosis and repair of home network related problems, information sharing between all of these stakeholders is a crucially important, yet wicked problem.

3.6. **Summary**

In this chapter, I identified four sources of difficulty and confusion for householders engaging with residential technologies, including (1) generativity and statefulness of devices; (2) invisibility of network infrastructure; (3) experiences and expectations of householders; and (4) lack of coordination between stakeholders. Given these four sources of difficulty and confusion, it seems there is no technological silver bullet for addressing the problems of residential computing infrastructures. For instance, no system for automatically correcting and detecting errors can account for user misunderstandings about what the technology can do or how various components are connected together. Nor can they account for non-technical requirements that are not easily articulated. In the following chapters, I will discuss how the *domestic economy*, or division of labor within the home with respect to home technology maintenance, amplifies these confusions and difficulties. I will also discuss how going beyond a technological approach to residential computing setup and maintenance (e.g. automatically correcting and detecting errors), and considering the needs and expectations of home users, we may find new opportunities for the design of tools for home computing assistance.

4. HELP AT HOME STUDY

Recall that in Chapter 3, I identified challenges of home computing related to the generativity and statefulness of home computing technologies, the relative invisibility of home computing infrastructures, the experiences and expectations of householders, and the lack of coordination between stakeholders involved in the upkeep of residential computing infrastructures. How, though, do householders cope with these challenges?

For many people, home computing and network setup and maintenance requires having someone with technical knowledge—whether paid or unpaid—to take primary responsibility for the care and maintenance of these computing systems; this fact has been documented by prior studies (Grinter et al. 2005, Chetty et al. 2007). However, what are the implications of having *no* expert, or no one with even a slight interest in digital do-it-yourself activities within the home? In what situations do householders turn to professional support services? Moreover, in what situations do they turn to informal sources of support from knowledgeable family members and friends?

In this chapter, I address **RQ2:** "***What mechanisms are householders using to cope with confusions and difficulties related to the setup, maintenance, and use of residential computing infrastructures? What are their motivations for choosing these mechanisms?"*** To answer these questions, I conducted a qualitative interview study with sixty people who had asked for or provided technical help in the previous twelve months (Poole *et al.* 2009a). What this study reveals is that *informal* sources of support from knowledgeable family members and friends play an important role in the upkeep of residential computing infrastructures.

This chapter provides information about computer helping practices in domestic settings as well as the motivations for participation in informal technical support. While studies of technology

related help giving and help-seeking are by no means new areas of study, most prior research focuses on workplace settings; I found previously undocumented characteristics of technological help-seeking in residential settings that are *different* than what has previously been documented in studies of workplace technological help-seeking by the CSCW and HCI communities. For instance, why do people agree to help their family members and friends, presumably for nothing in return? What methods do they use in their informal supporting practices? What challenges do they face when providing help to people within their social network? In this study, I show that *social roles* temper how and when informal support is provided. In the following sections, I describe the theoretical framework guiding this work, study design and analysis techniques, study results, and implications for design.

4.1. **Study Design and Analysis Techniques**

The study data comes from semi-structured interviews with sixty people who participated in informal technical support in the past year. The interviews were conducted by me, an undergraduate student whom I supervised, and students enrolled in the spring 2008 offering of CS 4690/6455: Empirical Methods in HCI. Overall, sixty interviews were conducted. Forty-two participants primarily provided support for others, and eighteen primarily asked for help. Participants were at least 18 years old, and were recruited by word-of-mouth. The interviews varied in length from 30-60 minutes. Participants were asked questions about the people who they helped (and who helped them), the types of problems encountered, techniques used to prevent or solve problems, resources used to solve problems, contact methods and frequency of help requests, and questions about solving various hypothetical problems posed by the interviewer. All the interviews were recorded and transcribed. The guides used in the interviews are included in Appendix A.

Categories of interest were determined through inductive reasoning, following in the traditions of a number of qualitative analysis techniques (Strauss and Corbin 1990). Three analysts coded interviews independently, and then worked together to arrive at mutually agreed upon themes. The excerpts that appear in this chapter are representative examples of commonly occurring themes in the data. In addition to analyzing the data for categories of interest, I used the ethnographic decision modeling technique to understand how helpers decide *who* to help, as well as *how* they to provide such help. Ethnographic decision models, as described by Gladwin (Gladwin 1989), are developed using qualitative interview data, and provide descriptive and explanatory power about how and why members of groups make choices. There are two types of ethnographic decision models; the first are descriptive models that describe the results only of empirical data collected. An extension of these models is to create *predictive* ethnographic decision models. These models attempt to have predictive power for data not collected by the researcher, and aim to predict decision making with an 85-90% accuracy rate.

To understand the decision making process that occurs when help is provided, I created two ethnographic decision models based on the interview data. These models, developed from iterating through each participant's accounts of helping instances, provide insight into factors influencing who is helped and in what ways this help is provided. Note that in order to claim that the models I have created are *predictive* in nature, future validation research is required. **Figure 4.1** describes the decision process of deciding whether to help someone. **Figure 4.2** describes the process of deciding how to go about providing help.

4.2. Theoretical Framework

In explaining the results of this study, I frame my results in terms of *role theory* and *politeness theory*. These complementary theories have been used extensively across the social sciences to explain

human interactions. Role theory "concerns one of the most important features of social life, characteristic behavior patterns or roles—the fact that human beings behave in ways that are different and predictable depending on their respective social identities and situation" (Biddle 1986). That is, people act in predictable ways based on the social roles they occupy (i.e. social role of being a parent, police officer, parakeet owner, and so on).

To preserve, enhance, or diminish roles in everyday life, people engage in *facework* with one another (Metts 1997). Facework consists of verbal and non-verbal communications that preserve (or in some cases restore) one's image or identity over the course of an interaction. While the concepts of *face* and *facework* are most frequently associated with Goffman's *Presentation of Self in Everyday Life* (Goffman 1959), an extension of this work by Brown and Levinson, called *politeness theory* (Brown and Levinson 1987) is most relevant to my studies of technical help in residential settings.

Politeness theory takes Goffman's concept of face and breaks it into two categories: positive and negative face. Positive face is the maintenance of being seen as likeable and competent (most like Goffman's definition of face). In addition to positive face is negative face, which is the desire to be free from constraints, impositions, and impedance. For instance, being the recipient of technical advice might also be threatening to negative face; these actions could be seen as "butting in" or "being nosy."

4.3. Challenges of Stakeholder Coordination Make Informal Help Preferable

Recall that in Chapter 3, I discussed how a lack of coordination between all of the parties who are involved with the upkeep of residential computing infrastructures causes difficulties. There are a number of stakeholders involved in a home's computing infrastructure, including hardware manufacturers, software vendors, internet service providers, and others who may have at some

point assisted with setup or maintenance tasks. Helpers overwhelmingly reported that their family and friends did not know where to look for help resources, and seekers also noted difficulties discovering whom to contact for problems:

> S09: It's hard to get a hold of people that are the makers or the support for the application. You have to go through a thousand numbers to get to them.

Keep in mind, also, that these stakeholders may have needs that conflict with that of the consumer. Technical support costs manufacturers significant amounts of money; thus, they may limit the amount of help a consumer can receive at no cost. S09 reported how, due to costs, one would have to "choose carefully" whether to contact a professional support service:

> S09: I called Microsoft support and they were pretty helpful. But apparently, you only get two free calls. So you have to use them wisely even though you are having trouble with your computer.

If the number of free support calls is not limited, however, the quality of support received may not be quite as satisfactory as S09's experience for several reasons. First, in-person and telephone-based support services require significant time commitments. Calling technical support lines involves navigating lengthy automated menus and waiting on hold. In-person help involves long waits for technicians to arrive. Second, once these help resources are available for a seeker, additional time may be spent retrying troubleshooting steps previously taken before contacting the outside stakeholder. Most importantly, however, in call centers, workers may be rewarded for spending as little time as possible on calls rather than on finding truly appropriate solutions for customers. Thus, given the conflicts between the needs of the consumer and the needs of the technician or the manufacturer, it is unsurprising to find situations in which the customers are left unsatisfied. Similar to the findings of my earlier study of technical support phone calls (Poole *et al.*

2009b), both helpers and help seekers in this study recounted experiences in which their problems were not resolved. In these cases, they were told that another party was at fault and were left with no solution. H36's experience in particular reflects the struggles of dealing with multiple stakeholders:

> We had a very hard time setting up the Mac with internet. The ISP would say it was Apple's problem, and Apple would say it's the ISP's problem, and both of them are like 'it's not us!' So we had to interface between groups that couldn't seem to get their act together. Then to top it off our phone company was saying 'ha ha, it's all of y'alls' fault!'

In an attempt to prove that the problem was the phone company's fault, the participant's father plugged the computer in at various points around the neighborhood:

> H36: My dad plugged it into our house. It didn't work. Took it out to where it comes in from the street to our house, plugged it in there, didn't work. Took it out to the line where it actually intersects in the neighborhood, plugged it in, and it didn't work. So to the phone company he said 'it's your problem'. I mean, my dad was carrying the thing around like a little 2 year old and plugging it in everywhere...It was pretty funny but at the same point in time, it's a source of frustration.

After having these sorts of experiences happen to them personally, or hearing rumors of poor technical support experiences, help-seekers would turn to people within their social networks in order to make sense of which stakeholder might be responsible for a given problem. By contacting a known person, time and financial costs were lower, and the process of getting technical help became simpler, as there were fewer points of contact. Furthermore, people within one's social network often had a better understanding of the seeker's technical competence and home technical environment, and could calibrate solutions accordingly.

4.4. The Technical Expert as a Social Role

How does a help-seeker know *whom* to contact? As described in Chapter 2, there is a sizeable body of literature in HCI and CSCW describing the difficulties of expertise location, particularly in studies of workplace help seeking. However, the study described here shows that in residential settings, finding an expert is not so challenging. In this section, I trace how people come to fill the social role of *technical expert,* and how potential help-seekers identify them. I also explain how the role of *technical expert* and *family member* intersect to put helpers in sometimes uncomfortable situation in which they are perpetually required by these social roles to provide help even if they do not want to do so.

4.4.1. Becoming a Technical Expert

Helpers in this study came to their calling in different ways depending on the age at which they started helping. For instance, helpers in their twenties reported that they had used computers and—perhaps more importantly—*tinkered* with computers since an early age. Many had, while growing up, supported people in their neighborhoods, or volunteered to provide IT support services in the schools they attended. Older helpers reported that they had learned about IT many years ago in the context of their jobs, or had been electronics hobbyists from an early age.

None of the helpers interviewed ever had to advertise the fact that they were experts with computers and willing to help solve problems. Rather, others came to them unsolicited to ask for help. Over time, helpers developed a reputation for being technically skilled, with word of their technical prowess quickly becoming known to family and friends; they developed a role within their social networks as being a *technical expert*. As one helper remarked:

> H15: Everybody knew that I was pretty good with computers. It was just natural that I would get pinged a lot on that sort of thing. I mean, I was young and had free time, so I could even do something like go to your house and play

> around with your computer for you. If you couldn't figure out what was wrong, that was the kind of service that's hard to buy cheaply, so...Like I said, I was going to be a computer programmer since, what, seventh grade? So everybody pretty much knew that I was a computer guy...that I spent a lot of time on computers.

For these helpers, technical support provided an entry into a world of creativity and problem solving; these opportunities afforded learning and exploration. Furthermore, for helpers who were teens when they first started helping, becoming technical experts often meant gaining the respect and admiration of peers and adults, as well as a newfound source of income. Other people became helpers in college by virtue of being associated with a computer-related degree program. Studying computer science or engineering suddenly bestowed them with the abilities to help in the eyes of their family and friends. Said one helper:

> H04: It just all began when I decided on my major [electrical engineering]. I just fixed things and learned at the same time...Actually, I remember feeling excited when I first helped someone out.

These helpers, who learned as they went, found it empowering to fix problems. Yet they also reported that the joys of providing technical support quickly faded. This transition influences whether and how a helper will provide assistance; more details of this process are described in Figure 4.1. In short, as computer expertise grew, technical support activities served less as a learning experience or a way to express creativity; problems that once excited them became mundane. Additionally, many found that as they gained adult responsibilities, finding time to keep abreast of technological advancements (e.g. particulars of the latest computer hardware, or all of the possible configurations of a piece of software) was increasingly difficult.

4.4.2. **The Intersecting Roles of Technical Expert and Family Member/Friend**

Despite this sentiment, helpers continued providing technical support primarily out of a sense of obligation; even if providing technical help was no longer fun, it was expected because of the intersecting social roles of technical expert and family member/friend; by holding both of these roles simultaneously, technical help for family and close friends was an expression of caring. Remarked one helper:

> H27: It [technical support] mostly sucks...My attitude is resigned. I am resigned to providing tech support. My part time help that I provide to people is out of the goodness of my heart. I mean, I don't get any satisfaction in doing it...Most of the satisfaction I get is like, this is like part of our relationship, but it's part of a much bigger relationship with like my parents

The preference for a given helper stands in contrast to what is known about help seeking in organizational settings. In particular, research on workplace help-seeking notes that physical proximity is one of the largest indicators of who will be called upon as a helper; I did not see this trend widely reflected in this study. Help-seekers would sometimes wait for months until their preferred helper (e.g. a child away at college) visited. While some help-seekers would try to contact their favorite helper by phone, many were likely to queue up questions until the preferred helper was available in-person.

Much of the organizational help seeking literature also underscores that help seeking in workplaces is *lateral* in nature; people seek help from others who are at similar levels in the organizational hierarchy or who have similar levels of technical expertise (cf. (Lang et al. 1982, Bannon 1986, Lee 1986, Clement 1990, Lee 2002, Twidale 2005)). Yet I did not see this trend in the data. In the workplace, a preference for peer-provided help may be due to workplace reward structures, and differing requirements for managing one's identity within the workplace. For

instance, asking for help requires a seeker to admit his or her lack of competence, inferiority, and dependence on others. These traits may not be desirable in workplace settings, where workers must manage their impressions carefully in order to gain respect or to be candidates for promotion or other incentives. Thus, in workplace settings, people may be more likely to ask from help from peers or otherwise avoid asking for help all together. In contrast, being a helper to one's parents does not detract from one's role of being a child. Technical help for family and friends *does* bring different sorts of concerns about social roles, but these concerns are different.

4.4.3. **Deciding Whether To Help**

When analyzing the data for this study, I created an ethnographic decision model (Gladwin 1989) that explored the factors that lead a helper to decide whether or not to help. In this section, I will explain the model in more detail. The foremost factor in deciding whether to help was to determine if the help-seeker was having a "computer emergency." A computer emergency could best be described as a crisis that is absolutely of the utmost importance and time critical; helpers reported that in nearly all computer emergencies, they would provide assistance of some sort.

For younger helpers, particularly teenagers, uninteresting, non-critical problems could be viewed as attractive and worthy of their skills, particularly if helping would result in financial payment, respect, or admiration. However, for helpers motivated primarily by one's social role rather than personal gain, help provision was more restricted. Help would be provided if these criteria were met: (1) the help-seeker was an immediate family member or friend, or the person asking for help was important to a close family member or friend; (2) the helper had time to spare at the moment (if not, help may be deferred or provided in a degraded manner); and (3) the help seeker was requesting assistance with a technological platform that the helper knew how to support to some extent. If the person requesting help were *not* a family member, friend, or person

otherwise important to help, then the deciding factors of whether to help included the following: (1) the helper had time to spare at the moment; and (2) the problem was deemed interesting to solve.

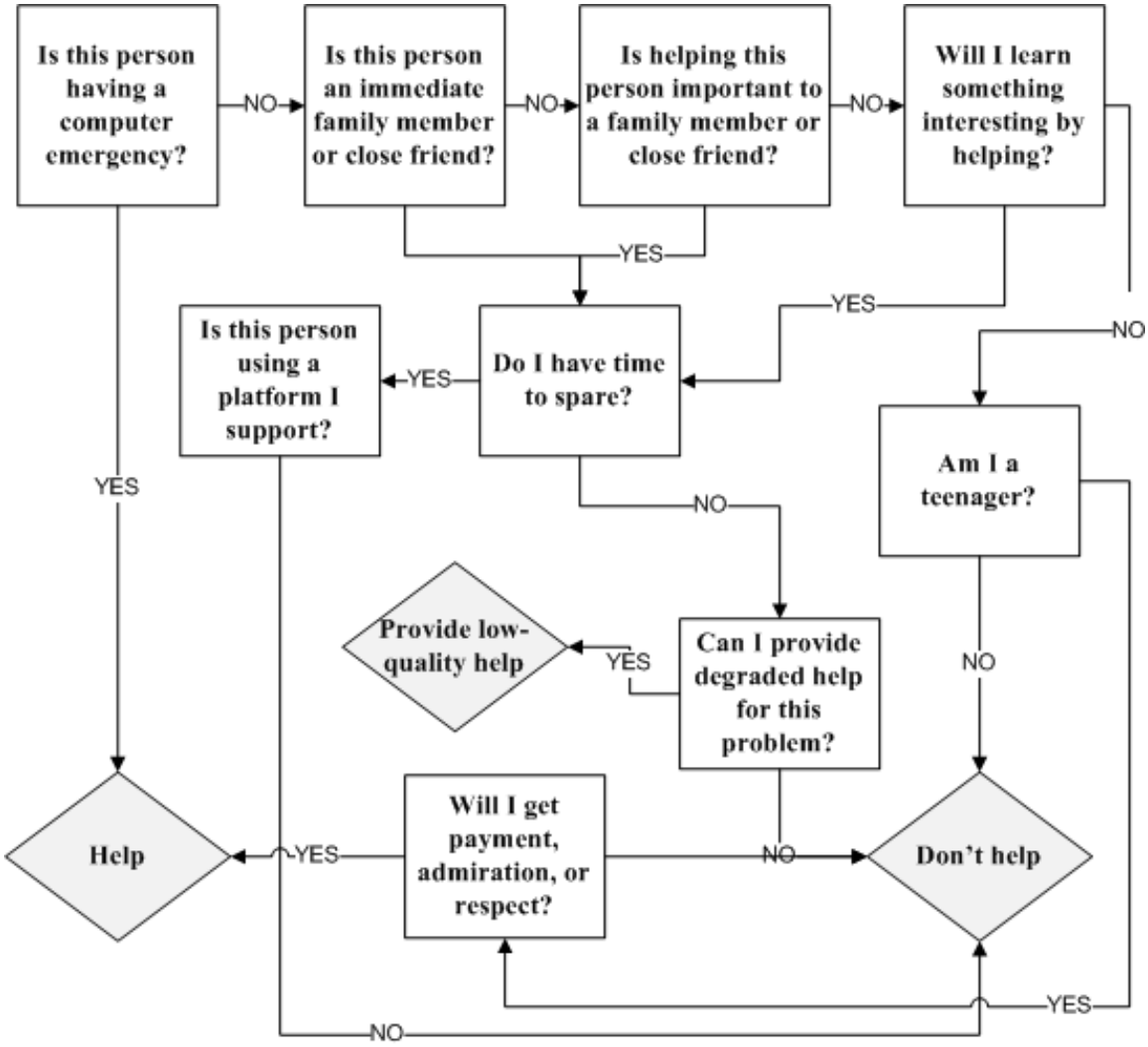

Figure 4.1: Factors Influencing Decisions to Provide Help

4.4.4. **Presentation of Self: The Helper's Perspective**

Another factor, however, also played into consideration when selecting problems to solve. While lack of time or lack of ability to support a particular platform may be an understandable excuse for bowing out of helping responsibilities, these excuses may in many cases have been just that: excuses. Helpers described how they took active steps to manage their identities as *technical experts*. This identity management process played a role in a helper's decision of *which* problem to solve, the ways in which problems were tackled, and providing of accounts of why problems were unsolvable.

My findings suggest that there is much active "front stage" work helpers do in order to maintain seekers' perception of them as computer experts (Goffman 1959). These findings reflect Orr's account of printer repair technicians; the technicians in his study also took careful steps to manage their identity as experts when interacting with customers (Orr 1996). For instance, H05 described his desire to appear to be the expert:

> H05: If it's like in person of something I want to be the expert. I do not want to come in and be like "I don't know." I want to be able to answer all the questions if they have any questions. If they are interested in knowing what's happening, then I'll be able to explain everything. If they are not interested, I would still want them to be able to know what's happening so they don't call me back later to help with the stuff.

H03, more bluntly, reported actively withholding information from seekers in order to preserve reputation as a technical expert:

> H03: I'll never tell them [people I help] that it's simple though because they think I'm a technical genius. I go over and oh, I don't want them to think it's that simple, you know, all you have to do is turn it [the computer] off.

Helpers reported that others thought they knew far more about computers than they actually did:

> H17: You know a little bit about computers, even a miniscule amount more than someone else, and they automatically assume you know all the rules.

Thus, they would take steps to ensure that they seemed like experts. For instance, they would look up reference material—typically from online resources—in advance of in-person visits in order to be prepared to solve the problem. When helpers encountered problems they could not solve, they had to find strategies to explain these awkward situations without losing face:

> H07: It can be frustrating; especially if you cannot find the problem solution and it gets you thinking after the conversation is over. It stays with you for a while. You feel disappointed if you cannot help them...It puts a strain on the relationship. You're getting frustrated. They're getting frustrated with you. You don't know what's wrong. They don't know what's wrong. You're equally trying to find the answer to the problem. It's a mixed feeling.

When primarily driven to help out of a sense of accountability to their close family and friends, helpers took steps to limit access to their services—that is, they took steps to preserve what Brown & Levinson describe as *negative face,* the desire to be left alone and free from obligation. However, concerns about being polite sometimes made it awkward to "draw the line" and turn away people who were not close. For instance, sometimes helpers were pressured by their families into assisting people they did not care to help. As H12 described this situation:

> H12: I always hated that my mom agreed for me to help her friends without my permission… I don't even know her friends and when I help her friends, I have so much pressure that I have to get it fixed or my mom will be disgraced.

Even without having pressure from close family members, helpers at times could not bring themselves to deny access to people outside of their immediate social network in a direct manner. For instance, rather than saying he could not provide help, H39 attempted using hourly charges for

his services to discourage people at the periphery of his social network. This strategy, however, backfired. By charging high prices, it only bolstered his reputation as a technical expert:

> H39: I started charging an insane amount, like a hundred dollars an hour. But it didn't work. Instead of making them go away, it made them say 'Wow, this guy must really know his stuff. Why else would he be charging so much?'

Another polite way to get out of helping was to offer a poor quality of service, or to provide help that did not require much effort on the helper's end. Techniques could include things such as providing a one or two sentence answer to the problem, or referring the help-seeker to another resource without any "hand holding." As H05 described this process:

> H05: If some person I don't know would ask me about a problem I would try to help from where I am. I think eventually I would give a list of people they might want to call...like Comcast, or Netgear tech support or something like that. But for someone I know, like my friends, I might go as step further and say well 'when you get home give me a call and explain what's happening and I'll see if I can help you over the phone or over IM.

Finally, in order to avoid helping with uninteresting, time-consuming problems, some helpers would simply lie about what they knew to certain people, even though they wanted to maintain their reputations as technical experts more generally. H32's experience is particularly salient:

> H32: Over time as people learned that about me, it became kind of a thing I had to keep quiet about around certain people. Because I know they'd ask me a question about it. There was this one lady in high school, actually she was the librarian, and I kept my mouth shut around her all the time...because if I ever let her know that I know about computers like I did, she would always be like 'Well, help me! Help!' ...and it'd be like book marking a page or something, and it'd take her 20 minutes to learn how to do it. So I'd be like, I don't really know how to do that either. I'd just lie.

In summary, helpers took a number of steps to maintain their personal identities as technical experts; however being a technical expert did not mean that they wanted to be equally available to all parties. Thus, helpers took a number of steps to limit access to their services, without hurting the feelings or offending the people who were requesting help of them.

4.4.5. **Presentation of Self: The Help Seeker's Perspective**

Help-seekers, too, were also concerned about their identities; this phenomenon will also be discussed in more depth in the *Family Facilitation Study* in Chapters 5-8. Help-seekers were, in many cases, well aware of the burden they placed on helpers. Although some seekers simply wanted their computer problems fixed, and did not care about how the fixes occurred, others—especially those who thought they might face the same problem again—wanted to learn about causes and solutions to problems. These seekers, however, would attempt to be polite and not ask their helpers to slow down, repeat themselves, or explain things in different ways.

Although they may have been unable to keep up with the helper's pace, or confused by the answers they received, they would not ask for repeated clarifications because they did not want to waste the helper's time or be perceived as being a burden. As a result, when future problems recurred, seekers would not know how to solve them because they did not understand the fixes the first time around, and were too polite or embarrassed to ask for clarification.

4.5. **Help Strategies**

We have seen that help providers may attempt to limit access to their skills and knowledge. How, though, is this decision to limit access or provide downgraded help operationalized? In this section, I describe the most common methods of provisioning help. Participants used a number of

techniques, including telephone-based, computer-mediated, and in-person help. The medium through which help is provided is largely determined by *personal accountability to one's social network*[5]. As previously described, social roles influence whether and how a person will be helped. If a helper feels a low level of accountability to a person asking for help, and the helper is not motivated by personal gain (e.g. learning, gaining respect or admiration of others), help is primarily limited to remote consultations.

High accountability corresponds with more in-depth remote consultations, and provision of in-person help, including troubleshooting, "digital housekeeping," and providing lessons on how to use various computer applications. Specific details of deciding exactly how to provide help are outlined in **Figure 4.2.** In the following sections, I describe the benefits and challenges of using different channels of communication for help, including helping over the telephone, over computer mediated communications, and in-person.

[5] Excluding "computer emergencies." In these situations, helpers were typically willing to provide their services to anyone in their social network who was in need. If the situation were not an emergency, however, helpers would restrict help.

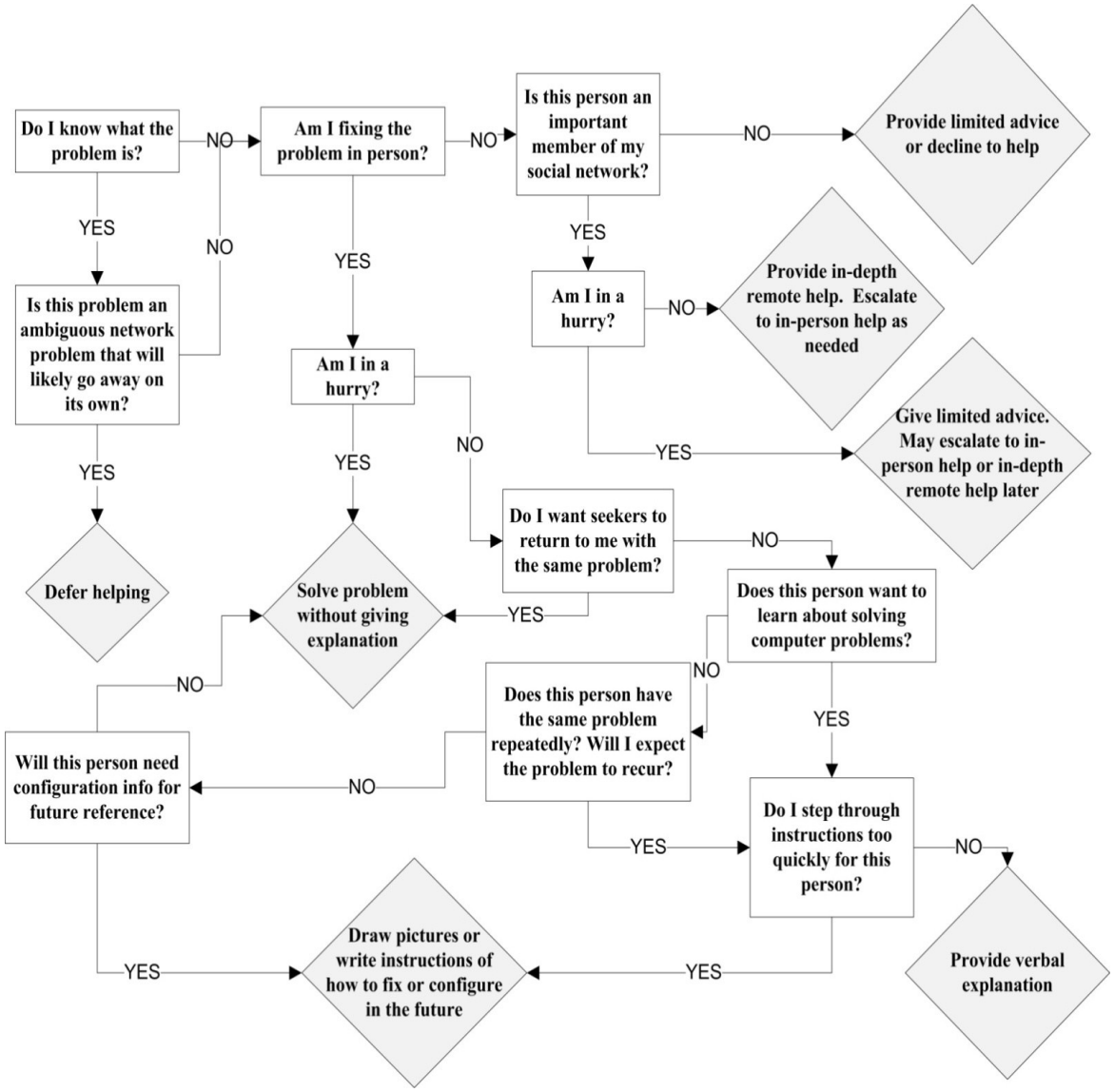

Figure 4.2: Factors Influencing How Remote and In-Person Help is Provided

4.5.1. **Remote Help**

Helpers provide remote consultations to all members of their social networks, either over the phone or over computer-mediated communications. Some of these consultations were unsolicited; for instance, seekers would call them on the telephone to ask for advice on accomplishing tasks such

as how to burn a CD, how to copy and paste, how to create boldfaced text, or how to attach files to email messages. The most computer-phobic seekers would call to get advice about what to do when an unfamiliar or threatening sounding dialog box with technical information appeared on screen; one helper reported that his mother called him regularly to ask questions about firewall permission requests that appeared while she used the Internet. In addition to providing advice about how to perform a variety of computer-related tasks, helpers also performed troubleshooting remotely. To ease the difficulties of remote troubleshooting, helpers developed strategies to establish shared viewpoints between themselves and seekers.

4.5.1.1. ***In-Advance Techniques to Ease Remote Troubleshooting***

Helpers who had taken responsibility for initially setting up computing equipment expected that they would be responsible later for troubleshooting problems. To overcome these expected future issues, they took steps that would allow them to troubleshoot problems remotely in the future. Tactics included using color coding hardware and cabling (e.g. by placing colored stickers in strategic locations on devices), as well as choosing hardware or software configurations that mirrored what they personally owned.

4.5.2. **Ad-Hoc Techniques to Ease Remote Troubleshooting**

Secondly, helpers used ad-hoc techniques during the troubleshooting process itself to establish shared viewpoints between themselves and seekers. Some reported that they would concurrently step through screens on their own computers to have a shared context while troubleshooting a problem remotely. One helper memorized the particulars of operating system and network configurations so he could step people through help over the phone without needing to have his computer nearby for reference. Another, who primarily provided help with graphics software packages, had seekers send screenshots via email. Surprisingly, only one helper reported the use of

remote desktop software to provide shared viewpoints; he provided computer support to his family living overseas and was unable to visit them in person if problems were too severe to handle over other channels.

4.5.2.1. ***Help Over Computer-Mediated Communications***

While all participants had tried using the phone at least once for giving or receiving help, they varied in terms of using computer-mediated communications, such as instant messaging (IM) as a helping tool. College-age helpers reported a number of instances in which they used IM to help their peers, but this method was not as common with older helpers. Said a helper with a college-age daughter (who also provided computer help to her friends):

> H34: I would never use IM instead of the phone for doing troubleshooting. That would be completely stupid. But I've seen my daughter sit there doing IM for half an hour and it could have been done in five minutes by telephone. I just cannot figure this out...I've never helped anyone by IM and I never will, unless there's something broken about the telephone.

By contrast, younger helpers and seekers at times saw benefits of IM in comparison to email or telephone. Said one helper:

> H32: Mostly I prefer IM over email just because email, there is a latency issue. If they know how to do an instant messaging, if they have it on their computer or whatever, then I do that...It is just easier to help someone do something. Say do this and you don't have to wait 5 minutes for them to do it and then open their email program back up and talk to me in an email, wait for the email to get to me, wait for me to respond. There's really short latencies between each email to add up very quickly over the span of lots of small minute steps. And especially if you try and give someone a walk through something, it's a nightmare.

Seekers who asked for help over IM described this medium as convenient because of its presence awareness features, quickly showing which helpers were immediately available for instant feedback

and advice and which were not. IM also provided a lightweight way to ask for help without unduly burdening or obligating potential helpers; problems presented via IM were seen by helpers and seekers as easier for helpers to dismiss casually, yet politely, if they were too busy.

IM was not without challenges. One of the biggest detractors of IM for helping is that if a computer is encountering problems, chances are that some component necessary for communication over IM (such as a functioning operating system or Internet connectivity) may not be available. When the misbehaving technology is itself the one used to deliver help, the practice of help giving can be stymied.

Physical requirements also played into reasons for not using IM. In certain circumstances, seekers needed to be able to use both hands or move to locations away from the keyboard to solve computer problems, making typing difficult without "moving back and forth." Similarly, IM requires more visual attention than using the phone. Some participants also noted difficulties in conveying their thoughts without "writing a novel" (that is, if they had adequate vocabulary to describe the problem in the first place). The design of the *Tech Clips* software used in the *Family Facilitation Study* described in the following chapter takes some inspiration from this use of IM for help giving; these features are described in detail in the Chapter 5. To summarize them here, the design integrates the presence features of IM, logging of prior communications as many IM clients use, as well as the ability to communicate remotely in real-time. Unlike IM, however, contains features that ensure it remains useful in the event the network fails, and does not solely rely on text-based communication.

4.5.3. **In-Person Help**

For people driven to help their family and friends out of a sense of accountability, help giving could be provided in person, and was strongly intertwined with holiday visits. This help giving came in

three forms: digital housekeeping, teaching, and problem solving. I discuss all three in turn. Helpers reported that whenever they visited family members, they engaged in routine digital housekeeping tasks such as installing or upgrading hardware and software, removing spyware, and virus scanning; these tasks were seen as a requirement of participating in the simultaneous role of family member and expert.

Similarly, some seekers who visited helpers during the holidays would bring their computers along for repair and housekeeping. Helpers also provided advice during visits. Seekers would casually ask computer-related questions during helper visits, and when visiting very young or old relatives, some helpers reported giving informal computer lessons:

> H20: My uncle [who is 80] got a computer...he'll ask me how to do stuff. He knows this is what I do, and I don't get to see him very often. He lives far away and he doesn't have any family, just me. So when I go there, he'll ask for a lesson. He was doing spreadsheets and Word, so I showed him how to do spreadsheets....We'll go over mail stuff, or... he was trying to order his medicine online, and he got confused. So we set him up an account, a password that he could remember and I wrote it down for him, and showed him this is where you go and this is how you do it.

Finally, during these visits, many seekers were presented with a list of computer-related problems to solve. For troubleshooting in-person—whether on a holiday visit or not—how involved the helper invited the seeker to be in the process depends on several factors described in **Figure 2.** In particular, these factors include whether the helper is in a hurry, whether the helper is intentionally withholding information to retain his role as a computer expert, whether the seeker shows interest in learning, and whether the problem is likely to recur.

4.6. **Summary**

In summary, householders, when coping with confusions and difficulties about residential computing infrastructures, may rely on a technically knowledgeable family member or friend to provide assistance. These informal helpers fill a gap between attempting to solve a problem alone and contacting a professional technician, whose services may be pricy and time consuming. Despite the advantages of using these help sources, however, concerns about face and social roles may lead to suboptimal helping experiences.

A limitation of interview-based studies such as this one, however, is that they rely on accounts of situations that may be fading from one's memory; it is difficult to remember, for example, specific details of how and why a particular technology failed. Additionally, in this particular study, my sample of participants was skewed far more toward *helpers* than *help-seekers,* and I did not gain much detailed information about the decision-making processes that lead people to decide that they require outside assistance whatsoever. Thus, in the next three chapters, I present a follow-up study that allowed me to learn more in-depth information not only about help-seeking and collaborative household computing maintenance practices, but also about approaches to *self*-help when encountering technology problems, and the processes by which people decide that a problem is manageable on their own or requires the assistance of others. From these findings, I discuss the ways in which software to support informal helping practices fit into the routines and social roles of domestic settings.

5. FAMILY FACILITATION STUDY DESIGN

The *Help at Home* study described in Chapter 4 identified methods and motivations for technical support practices in residential settings. What struck me in that study was the deep burden that helpers reported; even if they did not want to do so, they would agree to be perpetual technical helpers out of a sense of obligation to their family and friends. Similarly, help givers reported feeling as if they were a drain on their family and friends, but out of respect for the help giver's time, they did not always ask for advice that would truly help them.

In this chapter, I describe the *Family Facilitation Study*. During this multi-week trial, ten families set up, configured, used, and helped their family and friends with learning more about common home electronics and information technologies that prior studies have shown to be problematic. They also installed and used a piece of custom software, called *Tech Clips,* that allowed them to archive and share bits of computer related information (such as troubleshooting info, how-tos, and reminders) with family members and close friends.

This study offers two contributions to the HCI and CSCW research communities. First, it extends what we know about how householders cope with technological difficulties in their homes. Prior work (Grinter *et al.* 2005, Chetty *et al.* 2007, Poole *et al.* 2009b) suggests that when typical household support patterns are disrupted (e.g. the person who normally takes care of maintenance tasks is unable to do so at a given time), householders must take alternative paths to achieving their goals. However, we do not know much about what people actually chose to do in the moment; we just have accounts of events that are long since finished. Thus, I revisit the following research question this chapter:

- ***RQ2: What mechanisms are householders using to cope with these difficulties and what are their motivations for choosing these mechanisms?***

Second, I uncovered more in-depth knowledge about situations in which people will transition from trying to solve problems on their own to calling in outside resources, whether a person in the home, a knowledgeable friend, or a professional technician. I also examined how software tools for giving and receiving technical help within one's social network fit within the delicate fabric of home life, especially when normal technology maintenance practices are disrupted. Thus, in this study, I also investigated the following set of questions:

- ***RQ3: How does the presence of a tool with features grounded in the empirical research of RQ1 and RQ2 change the dynamics of domestic help provision? In particular:***
    - ***3.1: To what extent can software tools for giving and receiving help within one's social network help people become effective at completing home computing application tasks, and home networking setup and maintenance tasks?***
    - ***3.2: To what extent can software tools for giving and receiving help within one's social network help people become more confident about using and maintaining residential computing infrastructures?***
    - ***3.3: To what extent can software tools for giving and receiving help within one's social network decrease subjective perceptions of time and effort cost of providing technical help?***

In the following sections, I first describe the broad approach to the study, and then explain the details of the software used by householders. I then describe data collection techniques and recruitment process, and conclude with a description of each home enrolled in the study.

5.1. **Study Approach**

Within HCI, there has been a growing movement to study everyday life using *probes.* Probes, in one form or another, involve the introduction of artifacts into people's lives in order to encourage reflection on existing practices and opportunities for future technologies (c.f. cultural probes (Gaver *et al.* 1999) , technology probes (Hutchinson *et al.* 2003), infrastructure probes (Dorner *et al.* 2008), and problem solving probes (McDonald *et al.* 2008)). For a more detailed discussion of

probe use within HCI, Boehner et al.'s analysis of methodological assumptions embedded in probes (Boehner *et al.* 2007) serves as an excellent primer.

The *Family Facilitation Study* used two types of probes to understand technical practices within homes, as well as to identify unmet needs for provision of home technical support. The first probe is a *technology probe* called Tech Clips, which is described more in the next section of this chapter. Technology probes are research-specific systems that are intentionally simple and "under-designed." Intended for use in long-term field studies, these interventions are intended to be technologically robust (e.g., they are not mockups or partially functioning prototypes), and are instrumented to collect usage data. They are also flexible enough so that users may appropriate them in ways that the researchers do not initially anticipate. Technology probes aim to inspire and provoke discussion and ideas about future design possibilities, and to invite study participants to reflect on the role of technology in their lives.

The second type of probe addressed the issue of studying technology difficulties in-situ by providing a set of activities that caused technology problems to occur in households. Technology difficulties happen irregularly, and thus create challenges for data collection[6]. When data is obtained from studies in which people provide retrospective accounts (for instance, of technology difficulties that occurred in the past year), this approach can lead toward shallow accounts of the steps people take to resolve these difficulties, though they are excellent for understanding the *motivations* for ways they chose to resolve the problem.

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[6] Depending on the time of year, there are a few reliable opportunities to study technical problems in-situ. My research on consumer electronics help requests in online forums (Yardi and Poole, 2009) showed seasonal peaks in help requests based on events such as the beginning of the academic school year, post-Thanksgiving Black Friday sales, and Christmas gift-giving. A study that tracks consumers who purchase devices or give gifts of computers and electronics around these time periods could be another way to approach this type of research.

With these two issues in mind, following in the tradition of *critical incidents* (Flanagan 1954), I provided households with a second type of probe: a series of technology-related tasks intended to artificially disrupt the environment and force helping interactions to occur (since helping tasks are not regular instances). Furthermore, *all* members of a home were asked to participate in specific home maintenance practices, even if they did not normally do so. By shifting technology tasks to other members of the home, I could better understand the reasons that households divided technical labor in the ways they did. The tasks included networked hardware setup, media manipulation, teaching others about technology, creating web content, network configuration, sharing websites, and making technology purchasing decisions. A complete list of tasks is provided in Tables 5.1 and 5.2.

These tasks were chosen for several reasons. First, they are representative of the activities that householders may perform with computing infrastructures (Crabtree and Rodden 2004, Grinter *et al.* 2005, Brush and Inkpen 2007, Chetty *et al.* 2007, Elmore *et al.* 2007, Tolmie *et al.* 2007, Woodruff *et al.* 2007, Horrigan and Jones 2008, Horrigan 2010). Secondly, some of these tasks are ones that prior research suggests can be difficult. Finally, I also included a subset of intentionally *easy* tasks (e.g. searching for a popular video on YouTube, shopping online, and providing opinions on how to keep kids safe online) in order to prevent undue discouragement or disengagement with the study.

Table 5.1: Home Study Tasks for Week 1

Task	Week of study	Description of task
Photo Sharing	1	Take 10-20 photos with a digital camera and share them with someone so that no one else can see the photos.
Online Service Research	1 (pilot)	Imagine your dishwasher broke and you need to find the services of a plumber. Look online for a plumber to call. Email ___ the name of a great plumber, and the name of an awful plumber.
Online Product Research	1	Choose a virus scanner for purchase, with a $25 budget. Email ___ which software would be purchased, the price, and the place of purchase
MP3 downloading	1	Download 1-2 songs from Amazon.com. Find a way for others in the house to listen to the music without having to have their own copy.
Email vacation message	1 (pilot)	**C**reate a new web-based email account and enable a "vacation message" on it. Send an email from the new account to___.
Device Installation	1 (post-pilot); 3 (pilot)	Install a network attached storage device *excluding Pilot-Eileen, who did not have wireless Internet
Share Videos Online	1 (post-pilot); 2(pilot)	Find a video of dancing babies on youtube.com and share it with someone you know using Tech Clips *excluding Pilot-Nyree
Invite users to Tech Clips	1	Using gift bags, invitation cards, or the mechanisms within the software, invite people to use Tech Clips software * Pilot homes did not have gift bags or invitation cards, only a software invitation mechanism
Webcam Video	1 (post-pilot); 3 (pilot)	Create a webcam video of yourself and send the video to someone you know

Table 5.2: Home Study Tasks for Weeks 2-3

Task	Week of study	Description of task
Online Product Research	2 (pilot)	Look up information about Wireless N Routers and post to Tech Clips an explanation of what these devices do.
Online Product Research	2-3	Research laptops (imagining you would buy one). Send an email to ___ explaining: Which laptop you would buy, reasons for purchase, place to purchase it, cost, and reason for choosing a particular store.
Online Product Purchasing	3 (pilot)	Find an Amtrak ticket for a fictional elderly Uncle given a particular destination and time constraints.
Device Installation	1 (post-pilot); 3 (pilot)	Install a network attached storage device *excluding Pilot-Eileen, who did not have wireless Internet
Device Installation	2-3 (post-pilot)	Install and configure a wireless digital photo frame to either (a)display Facebook photos or (b) display photos sent via MMS
Wireless Router Install	2	Install a wireless router *only in Pilot-Eileen & Marietta
Wireless Router Configuration	2	Look up what MAC address filtering is; put MAC address filtering on wireless network
Wireless Printer Install	2-3	Install a wireless printer and print from 2 computers in the home. * excluded for Pilot-Eileen
iPod Configuration	2-3	Put mp3s on an iPod touch
iPod Configuration # 2	2-3	Configure iPod touch to use home wireless Internet connection
Edit Wikipedia	2-3	Change the wording on a Wikipedia page and post a link to the changed page on Tech Clips *excluded for Pilot-Eileen
Help Someone Edit Wikipedia #1	2-3	Call up a family member or friend who is not that good with computers. Explain to them what Wikipedia is, and coach them over the phone on how to change information on a Wikipedia page *excluded for Pilot-Eileen
Help Someone Edit Wikipedia #2	2-3	Invite a family member or friend who is not that good with computers onto Tech Clips. Create a new conversation that explains what Wikipedia is, and contains instructions of how to edit a Wikipedia page. Ask them to read these instructions and change the wording a page about a TV show that they liked when they were younger. When they finish this task, ask them to post a link to the Wikipedia page that they changed on Tech Clips. *excluded for Pilot-Eileen
Concerns of Home Life	2-3	Look up information about keeping kids safe online. On Tech Clips, post the top 3 things a parent can do to keep kids safe on the Internet
Concerns of Home Life	3 (pilot)	Imagine you get a device that lets you share files with other computers in the house very easily. Are there files that you do not think you would not want to share with people in your house? Or with other family members or friends? Files that your family or friends would not want to share with you? Send an email to ___ with answers to these questions
Webcam technical instructions	2-3 (post-pilot)	Using Tech Clips, make a video that provides instructions that could help someone else who is trying to do one of the tasks you did during this week. Share this video with someone who does not live in your house, and see if he or she can follow the instructions.

5.2. **Software**

During the study, each family installed and used a custom piece of software I designed called *Tech Clips*. *Tech Clips* allows families to broadcast short text messages, participant-created webcam video recordings, and websites of interest. Rather than using an existing computer-mediated communication tool, such as email, instant messaging, or a social networking platform, I chose to design a piece of standalone software. It is a standalone Adobe AIR software application that sits minimized in the system tray (Windows/Linux) or dock (Mac). I chose to create customized software so that I could incorporate specialized features that my prior work, as well as prior work on the psychology of help seeking, suggested would be beneficial in home settings. Note that families were not required to use Tech Clips for *every* task; for the majority of tasks they were encouraged to use whatever mechanism worked best for their situation.

Information in Tech Clips is stored in units called "conversations" (much like online forum threads). In the software, the user can do four things: start a new conversation, invite a friend to join *Tech Clips*, read or watch existing content, and provide text or video responses to content in existing threads. The conversations are shown in a panel on the left-hand side of the interface (see Figure 5.1) and specific content is shown in the panel on the right-hand side of the interface.

When someone is not actively using Tech Clips (e.g. it is minimized), any new content broadcasted by another person will appear briefly via a short pop-up message (see Figure 5.2) informing the user of new items in the system. In the event of network connectivity loss, content is cached locally. Due to technical limitations, however, webcam video recordings can only be seen when network connectivity is enabled.

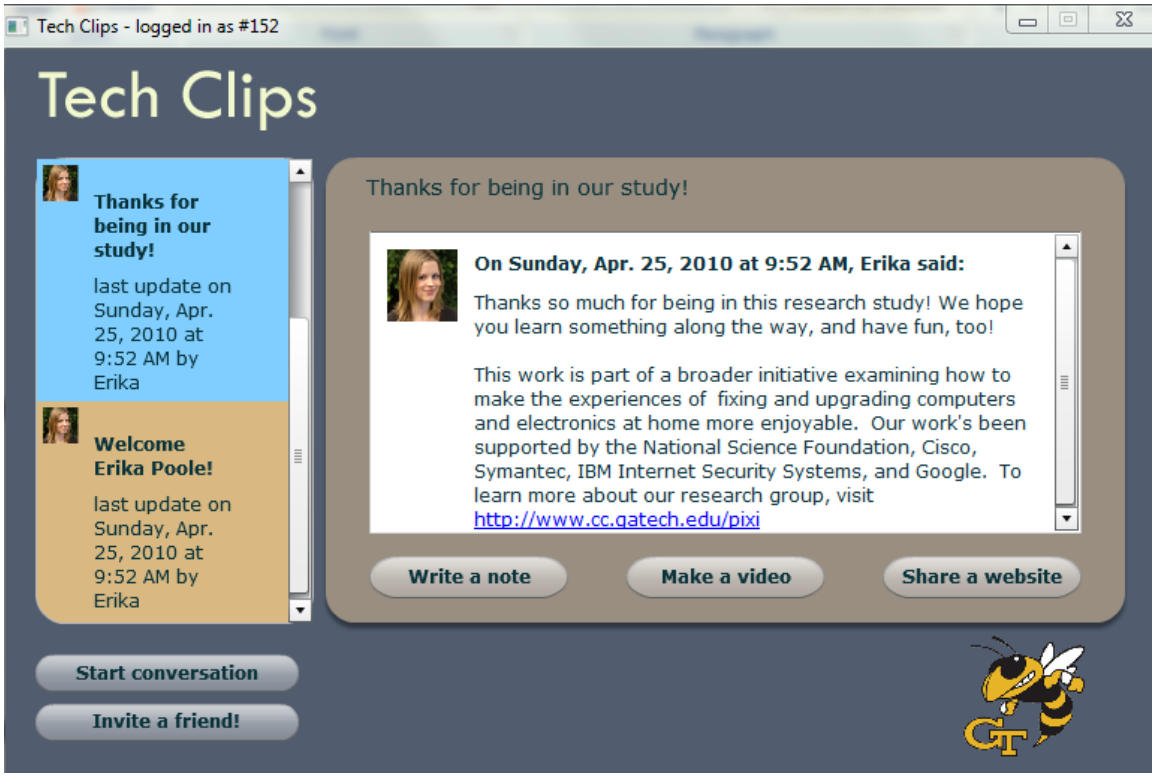

Figure 5.1: Tech Clips Software Interface

In Figure 5.1, the left-hand panel shows conversations, and the right-hand panel shows specific conversation content. Users may contribute content in three ways: (a) starting new conversations, (b) contributing a note, video, or website to an existing conversation, or (c) inviting a friend to use the software. In Figure 5.2, we see how users are notified of new content. In this screenshot, the user is working with a different piece of software (EndNote), and the Tech Clips interface is minimized. When someone broadcasts content, a Tech Clips message pops up in the right-hand corner, notifying the user of new info in the system. The user can then click on the Tech Clips icon in the system tray/dock in order to access the Tech Clips interface.

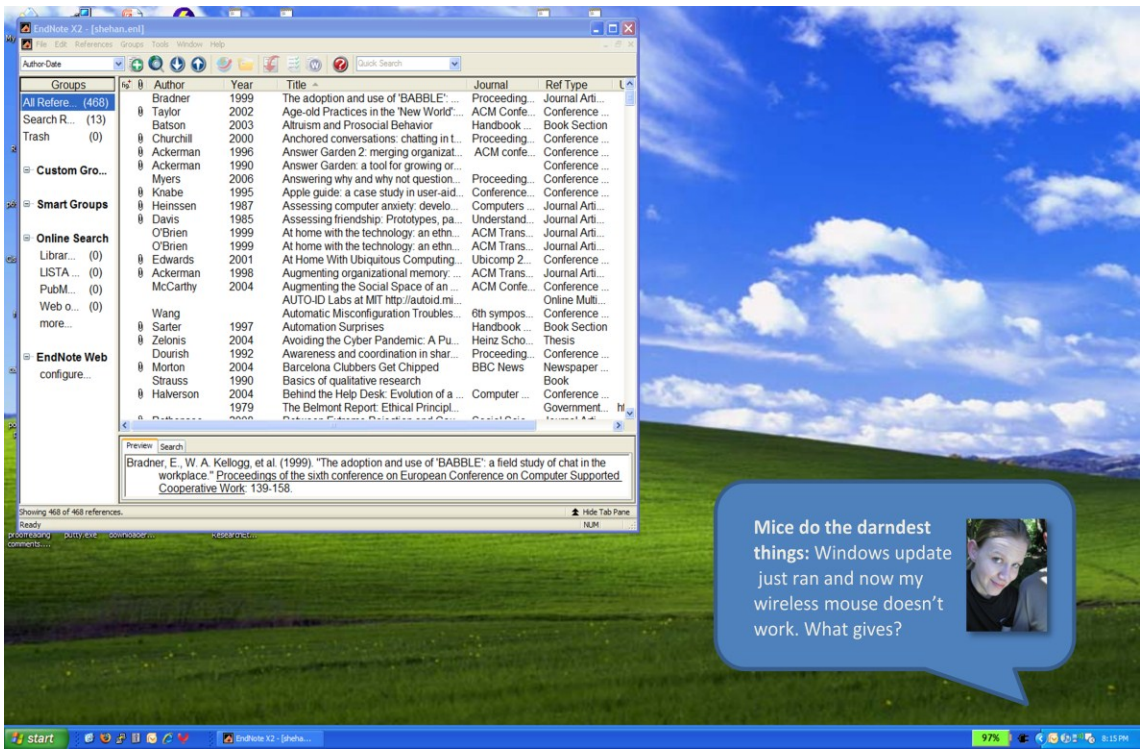

Figure 5.2: Tech Clips Message Notification

When creating *Tech Clips, t*here were a number of design choices made based on my prior work described in Chapters 3 and 4. First of all, content is never anonymous. It is always attributed to a user, and the user's photo and name are attached to their contributions. My prior fieldwork suggested that *who* is asking for help is an important factor in a potential helper's decision as to whether he or she will provide assistance. Also, note that *anyone can give help and anyone can get help.* No one is distinctly labeled a "helper" or "help seeker." This is done for two reasons. First, by not labeling a help seeker as a "person who needs help," it avoids explicit labeling of being novice, computer illiterate, or incompetent.

Secondly, help can be multidirectional; individuals may have different areas of expertise (e.g. I may know more about computer networks, but my mother may know more about graphic design applications). Prior research in online technical support communities provides supporting

evidence that help provision is rarely a simple interaction between a help-seeker and a help-giver (Singh and Twidale 2008). Multiple people can and do respond to help requests. These multiple contributions can have a positive effect on the help-seeking experience. Responders can provide procedural support, emotional support ("it happened to me, too!"), quicker response times, and additional contextual information that may help other people reading the thread. Further, people experiencing the same problems can reuse information in archived threads. For these reasons, I chose to design Tech Clips such that it broadcasts help requests to all users.

Because access to Tech Clips is restricted to people who are well known to the help seeker, the information in Tech Clips comes from a *trusted source*. Thus, it seemed likely that help seekers would view content in Tech Clips as more relevant and more understandable than advice coming from a stranger. Moreover, for help givers, providing advice to others who know them could potentially reinforce their offline identities as people who are knowledgeable about technology.

In my fieldwork of informal help at home (Poole *et al.* 2009a), lack of persistent help information presented itself as a hurdle for help-givers and help-seekers. Although help-givers would at time advise their friends and family about how to solve problems on their own in the future, through writing reminders, giving verbal advice, or having seekers step through problems while the helper was watching, these efforts did not work. People ignored the advice, misplaced written reminders, or forgot what the helper had taught them. Similarly, some help-seekers complained that although they wanted to learn by watching, helpers progressed through tasks too quickly for them to understand what was happening. Tech Clips supports persistent help provision by keeping information available permanently, and by not closing or removing threads of conversation.

In summary, Tech Clips was designed specifically to explore how embedding these sorts of features in a tool can alter the dynamics of home helping practices, and expose details about

existing helping practices as householders appropriate (or even possibly reject) the tool. For example, in the study of informal computer help described in Chapter 4, while some seekers simply wanted their computer problems fixed, and did not care about how the fixes occurred, others—especially those who thought they might face the same problem again—wanted to learn about causes of problems and how to prevent them from happening in the future. At the same time, however, these seekers noted that although they wanted to learn, they did not want to take up too much of the helper's time. Some would not ask any questions; they thought that the best thing they could do is just let the helper work quickly. Others who asked questions sometimes were confused by the answers they received, but would not ask for repeated clarifications because they did not want to waste the helper's time. As a result, sometimes the problems would recur, and seekers would not know how to solve them because they did not understand the fixes the first time around. Thus, could tools such as Tech Clips reduce the perceived amount of time and effort associated with providing or asking for technical help? If so, could they encourage people who were reluctant to ask for more help, or otherwise lower the barrier to help provision?

5.3. **Pilot Study**

The field study began with a pilot deployment in early 2010. The purpose of the pilot was to gain insight into appropriate tasks for households to complete, iterate on the format of logbooks used by participants, identify unforeseen technical problems with the Tech Clips software, and identify potentially interesting questions and issues to follow up on in homes that would participate in the revised version of the study. The pilot participants were compensated $75 for the entry interview, $75 for the exit interview, and $75 for completion of at least 50% of the tasks in the study.

The pilot deployment consisted of two homes (Pilot-Eileen and Pilot-Nyree) recruited from a convenience sample. Eileen and Nyree were two middle-aged females who had been

neighbors for the past six years. Neither woman was experienced or enthusiastic about setting up and maintaining technology at home, nor had any technical training. Both women relied on family members for technical help.

Neither had another adult living within the home full-time. Eileen, unmarried but with grown children, lived alone. Nyree's family situation was more complicated. Nyree and her husband were from another city with a very expensive cost of living. As their family grew in size, they could not afford to raise their children in this city, so they moved to the less costly suburbs of Atlanta, where Nyree's sister lived. Her husband, however, kept his job in the expensive city, and would primarily stay there, returning to his family in Atlanta every few weeks.

The participants in the pilot were connected to one another on Tech Clips, and every week, they were given a series of technology-related tasks to complete (See Table 5.1 for a list of tasks). A student assistant and I checked in with them weekly to get their feedback about tasks in the study; although not intending to do so originally, the student assistant and I joined as members of the deployment after the participants began addressing questions within the software to the research team. After the pilot study, the interview protocols, participant tasks, pre/post surveys, and participant logbooks were revised. Problems with *Tech Clips* were also fixed.

5.4. **Data Collection**

A student assistant and I visited each home at four points during the study (once per week), and conducted multiple interviews in the participants' homes; additionally we communicated with several of the study participants via email and phone calls.

Table 5.3: Participant Visit Schedule

Beginning of Study	• Administration of pre-survey • Group interview about technology setup, usage, maintenance, and help giving practices • Home tour • Installation of Tech Clips software
Home Check-in (Week 2)	• Brief discussion of Week 1 experiences • Collection of Week 1 logbooks • Distribution of Week 2 log books and equipment • Troubleshooting of Tech Clips software as needed
Home Check-in (Week 3)	• Brief discussion of Week 2 experiences • Collection of Week 2 logbooks • Distribution of Week 3 logbooks • Troubleshooting of Tech Clips software as needed
End of Study	• Administration of post-survey • Group interview reviewing logbooks from Weeks 1-3 • Collection of Week 3 logbooks • Two-part individual interviews about help practices • Removal of Tech Clips software

5.4.1. Beginning of Study Instruments

At the beginning of the study, each participant individually completed a questionnaire. This questionnaire inquired about demographic information, any technical background or hobbies, attitudes toward technology, attitudes toward helping other people (Communal Orientation Scale), and perceived confidence with a number of computing related tasks. It also included a social network mapping exercise in which participants listed people most involved with technology help in their lives.

5.4.1.1. Demographics and Technical Background Survey

The pre-survey included questions about age, highest level of education, technical training, enthusiasm about technology, and career. The full text of the pre-study questionnaire is available in Appendix B. While household income data would have been useful to collect (e.g. do homes with more financial resources rely more on professional services?) as well as racial data, I did not

want to make participants feel uncomfortable answering these sensitive questions and thus left them out of the questionnaire. Were I to do a similar study in the future, I might collect this data at the conclusion of the study, after rapport has been established with the participants.

In the survey, I also asked questions about confidence with various computing-related tasks, prior experience with various technology-related tasks, as well as enthusiasm about various technology-related tasks. I also asked participants to complete the Communal Orientation Scale (Clark *et al.* 1987), a scale from psychology that purports to provide insight into how willing a person is to provide or seek out help from others; I did not find this scale to be of particular use in my analysis; the scale seemed to have a social desirability effect – participants broadly reported that *of course* they were helpful people who would go out of their way for others. Whether this is an issue with the scale itself or whether university research studies do draw a pool of genuinely helpful people, I cannot say for sure. In summary, I did not find much use in including this scale and will not report on it further in the results or discussion of this study.

5.4.1.2. ***Social Network Elicitation and Home Network Sketch***

Following in the tradition of other studies of home computing infrastructure practices (Grinter *et al.* 2005, Chetty *et al.* 2007, Poole *et al.* 2008, Grinter *et al.* 2009), I asked each householder to create a sketch depicting the family's home network. While this technique has been used successfully in other studies, I am not certain it shed much light on my study beyond what has already been noted in the literature; the typical reaction I received from participants was something along the lines of "you expect me to do *what*? I don't know *anything* about that!" The sketches were similar to what has been reported in prior studies as well.

Participants were also asked to complete a survey addressing how frequently they ask for help from various sources. They were also asked to provide a free-form list of the top five people in

their lives who would they most likely ask for technical help, as well as the top five people in their lives who they would most likely be a provider of technical help. This second exercise, however, I did find useful as a launching point for discussion of technology maintenance practices within the home.

5.4.1.3. ***Group Interview, Technology Tour, and Software Installation***

After completing the pre-study questionnaire, participants engaged in a group ethnographic interview (Spradley 1979). The interview began with participants walking me through their lists of people who they help or ask for help. They told me about the expertise of these people, reasons they chose them for the list, and whether there were situations in which they would not choose a person. If, during the conversation, participants realized they forgot to add a person to the list, I encouraged them to alter their lists as necessary.

After this portion of the interview, I asked participants about their usage and maintenance practices with respect to computers, and asked them to take me on a "technology tour" of their home (in the style of (Rode, Blythe and Monk 2002, Grinter *et al.* 2005, Chetty *et al.* 2007)). During this tour, I asked questions about how technologies were acquired, how technologies were used, and how family members coped with technical problems. These questions were included to learn more about the normal routines of technology acquisition, use, and maintenance in the homes.

At the end of the first session, the householders and I installed the *Tech Clips* software, either on one computer, or on multiple computers, depending on the preferences of the family members. I then asked the householders to try creating example text and video content to test the software and learn how to use it. Finally, the interview concluded with an invitation to ask any questions about the study.

5.5. Mid-Study Data Collection

During each week of the study, automatic collection methods built into the Tech Clips software gathered usage data. I also gathered data through weekly in-person, phone, and email interactions with participants. Participants also maintained logs documenting their experiences with the tasks in the study.

5.5.1. Logging Software Usage

Tech Clips automatically logged all user interactions, including opening and shutting the software, creating clips, viewing clips, and generating invitations for others to use the software. This log data was sent to a server at Georgia Tech several times an hour, and if offline, would be queued on the participant's computer until Internet connectivity was restored.

5.5.2. Weekly Task Diaries

The families were also given a book of "homework" to complete over each week, tote bags with hardware to be used in these tasks, and several gift bags to give to family and friends who could be potential users of Tech Clips. The tasks the first week served as warm-up to acclimate participants to being in the study; weeks 2 and 3 included more tasks, as well as tasks that are more complicated. In the task books, participants completed a set of questions following attempts at each task. The questions asked about sources of help used and steps taken to complete the task. They were also given a page to write anything other comments they thought would be interesting or relevant. Finally, for each task, participants were also asked to complete the NASA Task Load Index (NASA-TLX) (Hart 2006). NASA-TLX, developed for use in aviation human factors, is a multi-dimensional scale that provides information about subjective assessments of how mentally demanding, physically demanding, and frustrating a particular task is. It also asks about the effort task requires as well as the participant's perception of their performance on the task. Despite its

roots in aviation-related studies, it has been used within HCI and human factors more broadly due to its compact, quickly administered format, and subscales that reveal specific, useful information about what specifically is perceived as being difficult or frustrating about a task a study participant is being asked to complete. In Chapter 6, I present histograms showing participant responses to NASA-TLX questions for each task. To interpret the histograms, a lower number corresponds to the task being "easier," whereas higher numbers correspond to tasks being difficult. For more complete information about interpreting the scale, please consult (Hart 2006). An example page from the task diary can be seen in Appendix B.

5.5.3. **Weekly Researcher Visits and Remote Interactions**

At the beginning of the second week, I visited the home to check in on how the tasks had gone and ensure that the software was working properly. At this time, I delivered a new task book and a new bag of equipment. For the second week, the participants were instructed to have the *less* technically oriented adult in the home complete the tasks[7]. This choice was made to disrupt the normal family dynamic, and to ensure that the most technologically skilled person in the home did not "take over" all of the tasks.

At the beginning of the third week, I checked in again with the households, and delivered yet another logbook. During the third week, participants were instructed to have the *more* technical person in the home complete the week's homework tasks. The tasks the third week mirrored, but differed slightly, from those during the second week. I had hoped that by first giving

[7] The *Marietta* deployment had a deviation in the second week. Both adults in the home were given tasks to do, because the market research firm accidentally recruited a home without wireless Internet connectivity. In this home, the more experienced householder was given four tasks during the second week: installing a wireless router, connecting a laptop to the wireless connection, connecting a Nokia 770 internet tablet to the wireless connection, and creating a webcam video.

the less technically oriented person an opportunity to try out the tasks, they might be able to turn the tables and help the person who was perceived as the home technical expert.

5.6. **End-of-Study Data Collection**

At the end of the third week, the householders reviewed the tasks books as a group, explaining their responses. I collected all hardware and task books, uninstalled the *Tech Clips software,* and asked the participants to complete a post survey addressing their confidence, enthusiasm, and expertise with technology, as well as their locus of control with respect to technology.

5.6.1. **Post Survey**

Participants completed a post-survey, repeating some questions from the initial study. In order to do a pre/post comparison, I asked participants to again rate their confidence with a set of technology-related activities, and to provide a list of the top five people they would ask for technology help, as well as provide technology help. Finally, due to uncertainties in one of the households as to whether a frequent (non-participant) visitor was an occupant in the house, I added one additional question asking participants to list people who live in their home, as well as those who visit their home and use technologies within the house. In retrospect, were I to do this study again, I would have asked participants to complete this elicitation of home occupants and visiting technology users at the *beginning* of the study.

Participants were also asked questions about their frequency and reasons for using Tech Clips. They were also provided with a list of possible reasons that they might *not* contribute to Tech Clips; they could select any that applied. This list was derived from Preece et al.'s research on lurkers in online communities, which identified numerous reasons that people may not contribute content to an online communication system (Preece *et al.* 2004). The full text of the post-survey is available in Appendix B.

5.6.2. **Group Interview**

We then engaged in a group interview, in which participants reviewed each of the tasks they completed throughout the study, and discussed their experiences with them. I let the participants "drive" this portion of the interview, letting them decide what was interesting to share. Based on what they said, I asked clarifying questions as needed.

5.6.3. **Individual Interviews**

With two interviewers present, we then split up participants in the home for a set of two activities. We interviewed each family member participating in the study individually about technology practices in the home, and asked them to discuss 30 mockups of products (e.g. software, customized hardware) that could be used to give and receive technology help. The mockups were customized for each home based on the social network exercise completed at the beginning of the study and touched on the most common forms of computer assistance described in the *Help at Home* study from Chapter 4, including:

- **Assistance with non-urgent questions about technology**: variations of synchronous and asynchronous Q&A via web chat, SMS, and social networking sites in which friends, strangers, and professional technicians could be asked questions
- **Assistance with hardware installation and troubleshooting:** variations of synchronous remote connection to another person who could assist with hardware installation problems (e.g. another person who has installed the device before, a technician, a knowledgeable high school student)
- **Assistance with digital housekeeping:** variations of reminders to perform digital housekeeping tasks provided by members of one's social network

During the mockups interview, the participants discussed their reactions to these concepts; I was particularly interested in their reactions as related to confidence building, reduction of burden, and overall meeting of technical support needs. In contrast to prior work that primarily relies on group interviews, by splitting participants up and conducting simultaneous individual interviews, householders could speak more candidly about sensitive subjects that may be uncomfortable to answer in the presence of other household members (for instance, providing accounts of times when they had avoided providing help to someone in the home).

5.7. **Recruitment**

At the conclusion of the pilot study, eight additional homes were recruited for the revised study. Of the remaining eight houses, one was recruited via the recommendation of a colleague *(Cascade* deployment) and compensated with the same $75/$75/$75 structure as the pilot study. The other seven were recruited using Schlesinger Associates, a market research firm in the Atlanta metro area. Participants recruited by this firm received gratuities as follows: $100 for the entry interview, $100 for the exit interview, and $150 for completing at least 75% of the tasks in the study. Compared to the pilot, these amounts were adjusted due to recommendations by the firm based on other studies for which they have recruited participants. Households were selected using the following criteria:

- The home has wireless internet (in order to provide a wider number of tasks for families to complete; the pilot study indicated this connectivity was an important thing to have.)[8]

[8] Upon initial interviews, I found that despite the screening criteria used for recruitment, the home in the Marietta deployment actually did not have wireless internet. The occupants were planning to install it in the home within the next six months; tasks were adjusted for this deployment so that week 2 included additional wireless internet installation tasks.

- There are at least two people age 13 or older living in the home; all adult members of the home willing to participate in the study[9]
- At least one person in the home has asked another person for technology help OR has provided technology help to another person in the past 12 months.

During the in-home study, households were also tasked with secondarily recruiting their family and friends to try the Tech Clips software; "remote" participants received compensation in the form of a $15 Amazon.com gift certificate if they installed the software and completed a short survey at the end of the study. In the pilot study, Eileen and Nyree had significant difficulties recruiting people to use the Tech Clips software; none of the people they invited joined. In order to increase the response rate, I added additional recruitment aids for the post-pilot homes. These homes received a set of 40 physical 5x8 cards that they could pass out to their friends and family that described the study and how to download the software, as well as a set of "gift bags" for each family containing a web camera, computer microphone, installation instructions, and candy.

During the first week of the study, inviting people to use the software was one of the tasks included in the task booklet. Across all of the homes, 10 remote participants joined Tech Clips. Two completed the remote participant survey that I emailed to them at the end of the study. These two participants indicated that they immediately uninstalled the software because they "didn't have time" to use it; most of the information I have about remote participant usage and attitudes toward Tech Clips comes from data automatically logged by the software triangulated with accounts relayed by the occupants of homes enrolled in the study. In the following section, I provide a brief description of each home's occupants, technologies in their home, and their computer habits. In the results chapters, I will provide more detailed descriptions of the households.

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[9] Upon initial interview, the second adult in the Austell deployment declined to participate in the study

Table 5.4: Technology Inventory (Pilot to Decatur)

Deployment	Home type	Internet connectivity	Computers/electronics
Pilot-Eileen	Detached home	Cable Internet; wired connection	• 1 Windows XP PC built by Eileen's son in spare bedroom • 1 printer
Pilot-Nyree	Detached home	AT&T DSL; secured wireless Internet connection; 2 wireless access points are used within the home to expand signal range	• 2 older laptops without Internet connectivity for small children (brand unknown) in "education station" room within the house • 1 internet-connected Dell desktop with Windows (version unknown) for teenage boy in bedroom • 1 internet-connected Dell laptop with Windows (unknown version) for teenage girl • 1 internet-connected Dell desktop with Windows Vista for parents. Located in bedroom. • 1 printer/scanner/fax combo machine. Located in parent's bedroom.
Austell	Apartment	Cable Internet; unsecured wireless Internet (highly unreliable connection)	• 1 Dell laptop with Windows XP; (hand-me-down from occupant's father) • 1 Dell desktop with Windows XP (unusable due to hard drive failure). Located in living room. • 1 iPod touch (also broken) • 1 printer. Located in living room. • 1 webcam (does not record video properly)
Cascade	Townhouse	Cable Internet; secured wireless Internet	• 3 Dell laptops with Windows XP; 1 laptop is owned by an employer • 1 iPod touch (has cracked screen but still works) • 1 Dell desktop (in storage due to viruses on machine) • 1 printer/scanner/fax combo machine in den (not used because installation disk was misplaced)
Decatur	Detached home	Cable Internet; secured wireless Internet	• 1 Dell laptop with Windows XP; 2 Toshiba laptops with Windows (versions unknown) • 1 Dell desktop with Windows (version unknown) in adult bedroom • 3 iPods • 1 printer in adult bedroom • 1 external hard drive in adult bedroom • Multiple digital cameras of varying ages stored in closet of adult bedroom

Table 5.5: Technology Inventory (Dunwoody to Woodstock)

Deployment	Home type	Internet connectivity	Computers/electronics
Dunwoody	Detached home	Cable Internet; secured wireless Internet	• 1 netbook with Windows 7 • 1 laptop with broken LCD (Windows; version unknown). Used as a desktop machine in guest bedroom/office • 1 external hard drive in guest bedroom/office • 1 digital camera
Marietta	Townhouse	Cable Internet; wired connection to desktop computer	• 1 Dell desktop with Windows XP in den • 1 Printer in den • 1 Dell Axim PDA that will not sync; used as a rolodex (in den) • 1 iPod Nano, 2 iPod Shuffles • 1 digital video camera (used for freelance media production work)
Lithonia	Detached home	Cable Internet; Wireless to laptop, cables to desktop machines	• 1 Dell laptop with Windows 7 • 2 Windows XP desktop PCs in basement office • 1 Broken laptop (stored in closet; cannot find AC adapter) • 1 wireless door unlocking system used for real estate showings • 1 printer/digital fax machine in basement office • 1 iPod Shuffle, 1 iPod Nano
Smyrna	Detached home	Cable Internet; wireless to laptops	• 2 windows XP laptops (belonging to employers). One is stored in a docking station in home office; the other does not have a home. The work laptops require VPN access coupled with restrictive security software. Tech Clips cannot synchronize unless the security software is disabled. • 1 Windows XP laptop (broken and in storage in a closet) • 1 Xbox 360 in home office • 1 LCD TV used as computer monitor in home office • 1 Wireless printer in home office • 1Professional-grade digital camera; 1 point-and-shoot digital camera • 1 iPod touch
Woodstock	Townhouse	Cable Internet; wireless connection to laptop, wired connection to desktop	• 1 Dell desktop with Windows XP in loft area on second floor. • 1 Toshiba laptop with windows XP (hand-me-down from family member who thought it was broken beyond repair) • 1 Dell laptop with windows XP (has a virus and is not used; stored near the desktop machine in the loft) • 1 iPod Nano • 1 Digital camera

5.7.1. **Austell**

Adrian Austell, a single mother in her late 20s, lives in a small apartment with her infant daughter, Nicky (1), and an older family member named Belinda. Adrian is a student in a nursing program, and uses a laptop to complete her schoolwork. She also has an iPod touch, and a desktop computer for games, music, and videos. Her boyfriend, however, had used file-sharing software on the desktop machine and inadvertently downloaded a file with a virus. Soon afterward, the hard drive failed on the desktop machine. Computers are an important part of Adrian's life, and a connection to people she cannot regularly see. Baby Nicky was very sick in her first year, undergoing several surgeries and spending months as a patient in a children's hospital. Adrian described her laptop and iPod as the key to her sanity during this period of her life; the hospital had wireless Internet access for parents to use while they stayed with their sick children. Adrian, who was not originally from Atlanta, had many family members and friends in another state. She communicated with them regularly to play online games and share baby photos. She was excited to show photos and videos of a finally healthy Nicky to her family and friends, but could not get a webcam she had purchased prior to the study to work properly. She did not have a technical expert in her home, but learned about technology through tinkering, asking a technically inclined teacher at her nursing school for advice, and by getting phone-based help and reminders from her stepmother, who lived in another state. Belinda did not use any of the computers, and declined to be in the study.

Table 5.6: Austell Demographics

	Occupation/ Education	Has technical training or self-describes as technically inclined	Describes self as a technical enthusiast	Approach to technology problem solving and maintenance
Adrian 23-29 / F	Single parent & student in nursing program/ Some college	No	Yes	Use of professional support services: telephone support lines (most of the time), in-store repair service (rarely) Asking social network: family member who doesn't live with me (most of the time), friend (nearly all the time), somewhat at work (most of the time) Self-help: Internet forums (nearly all the time), figure things out by self (sometimes)
Nicky 1 / F	*N/A - too young to participate in study			
Belinda 51-60/F	*N/A - does not use computers; declined participation			

5.7.2. **Cascade**

The Cascade home is an all-female family with a divorced mother, Viola, in her 40s, and three girls: Karina (19), Keisha (18), and Kassandra (13). Prior to the divorce, the girls' father, an electrical engineer, would take care of technology-related issues in the home. After the divorce, Keisha took over the role of in-home technical expert. Viola, who uses a laptop provided by her employer, also has access to a workplace helpdesk. Viola is interested in learning more about information technologies, but describes herself as "impatient" and "intimidated by" technology. Of the children, Karina and Keisha have their own laptops. Kassandra primarily uses an iPod touch and laptops owned by others in the house. Keisha and Kassandra enjoy using computers and the Internet, but Karina, who is studying to become a professional ballet dancer, is largely uninterested in technology. The girls get technical advice from their father.

Table 5.7: Cascade Demographics

	Occupation/ Education	Has technical training or self-describes as technically inclined	Describes self as a technical enthusiast	Approach to technology problem solving and maintenance
Viola 41-50 / F	Consultant/ Graduate school	No	No	Use of professional support services: technical help line (nearly all the time), in-store repair service (rarely) Asking social network: daughters who live at home (nearly all the time), family member who doesn't live with her (rarely), coworker (sometimes) Self-help: browse Internet forums (nearly all the time), figure things out by self (rarely)
Karina 19 / F	Dance conservatory student/ Some college	No	No	Asking social network: sisters (nearly all the time), father (sometimes), friend (rarely) Self-help: figure things out by self (sometimes)
Keisha 18 / F	Student/ High school	Yes	No	Use of professional support services: technical help line (nearly all the time), in-store repair service (sometimes) Asking social network: family member who lives elsewhere (sometimes) Self-help: browse Internet forums (sometimes), figure things out by self (nearly all the time)
Kassandra 13 / F	Student/ 8th grade	Yes	Yes	Use of professional support services: in-store repair service (rarely), technical help company visits house (rarely) Asking social network: sisters (most of the time), family member who lives elsewhere (sometimes) Self-help: browse Internet forums (sometimes), figure things out by self (most of the time)

5.7.3. **Decatur**

Jillian and Mike Decatur are a married couple in their 40s, and have two boys, Ryan (11) and Tate (6). Jillian owns a small home-based business and relies heavily on a computer for her work. A technically enthusiastic person, Jillian gained most of her technical expertise by hiring an in-home technician; while he was working on her equipment, she would learn from him. As she became

more technically competent, she used the technician's services less frequently. Mike, an unemployed scientist, is not particularly interested in computers, though he does have his own laptop. He does enjoy tinkering with wiring and electronics. Due to a mild hearing disorder, he is uninterested in technologies such as cell phones, mp3 players, and AV equipment. Ryan and Tate are not especially enthusiastic about technology, either. The boys are far more interested in sports and outdoor activities. Ryan has his own laptop and iPod, which were gifts from his grandmother, but does not use them very often. Tate does not have his own computer.

Table 5.8: Decatur Demographics

	Occupation/Education	Has technical training or self-describes as technically inclined	Describes self as a technical enthusiast	Approach to technology problem solving and maintenance
Jillian 41-50 / F	Owner of home-based business/ Some graduate school	No	Yes	Use of professional support services: telephone support lines (sometimes), in-home technician (sometimes) Asking social network: family member who lives elsewhere (rarely), friend (rarely), neighbor (rarely) Self-help: browse internet forums (most of the time), figure things out by self (most of the time)
Mike 41-50 /M	Scientist (currently unemployed)/ Undergraduate	Yes	No	Use of professional support services: telephone support lines (rarely), in-home technician (rarely) Asking social network: family member in home (sometimes), friend (rarely), neighbor (rarely), coworker (sometimes), Self-help: figure things out by self (sometimes)
Ryan 11/ M	N/A - Too young to participate in study			
Tate 6/M	N/A—too young to participate in study			

5.7.4. **Dunwoody**

Steve and Janine Dunwoody are a couple in their 30s, with two children, Allie (4.5) and Billy (1.5). Steve, an engineer by training, is technically inclined, but not enthusiastic. Janine, a former elementary school teacher, is extremely unenthusiastic about setting up, maintaining, and using technology. Of the children, Allie uses their computer in order to play age-appropriate web-based video games online. The family primarily relies on Janine's father, who lives several hours away and visited on holidays and Steve's brother, who lives a few miles away, for technical help.

Table 5.9: Dunwoody Demographics

	Occupation/ Education	Has technical training or identifies as technically inclined	Technical enthusiast	Approach to technology problem solving and maintenance
Steve 31-40/M	Engineering manager/ Graduate school	Yes	No[10]	Use of professional support services: Calls a customer service line (rarely) Asks social network: Asks younger brother (almost always); Asks a friend, neighbor, coworker (sometimes) Self-help: Looks for information online (sometimes), Figures out things on his own (most of the time)
Janine 31-40/F	Stay-at-home parent, former elementary school teacher/ Undergraduate	No	No	Self-help: Figure things out on her own (rarely) Ask social network: Ask father or Steve's brother (nearly all the time); Ask Steve (sometimes)
Allie 4 / F	N/A—Too young to participate in study			
Billy 1.5/ M	N/A—Too young to participate in study			

[10] individual interviews during the study suggest he is enthusiastic, especially about AV equipment

5.7.5. **Marietta**

Roy and Karen Marietta are a couple in their late-40s/early-50s with a 10-year-old daughter, Justine. The members of this home describe themselves as a "self-contained universe"; they do not seek help from others except by using online forums. All are enthusiastic about technology and self-taught, but due to financial constraints, they have a single aging desktop computer in the home. The couple has been out of steady work for the past year and a half. They rely on freelance contracts for income; for them, cost dictates whether new technologies will become part of the household.

Table 5.10: Marietta Demographics

	Occupation/ Education	Has technical training or self-describes as technically inclined	Describes self as a technical enthusiast	Approach to technology problem solving and maintenance
Karen 51-60 / F	Pre-school teacher (currently unemployed)/Completed college	Yes	No	Use of professional support services: telephone support lines (rarely) Asking social network: family member at home (nearly all the time), family member who lives elsewhere (nearly all the time), friend (nearly all the time), coworker (sometimes) Self-help: browse internet forums (most of the time), figure things out by self (most of the time)
Roy 41-50 / M	Freelance media content developer/ Completed college	No	Yes	Use of professional support services: telephone support lines (sometimes), in-store repair (sometimes), in-home technician (rarely) Asking social network: family member at home (rarely), friend (most of the time), coworker (sometimes) Self-help: browse internet forums (nearly all the time), figure things out by self (most of the time)
Justine 10 / F	* N/A – Too young to participate in study			

5.7.6. **Lithonia**

Jamar and Deedra Lithonia area couple in their thirties, with one son, Jamar Junior (2). Jamar Jr. watches videos on the computer that were set up by his parents, and knew how to operate a portable DVD player. Overall, though, no one in the home has much technical expertise, and Deedra describes herself as "easily frustrated" and "intimidated by" computers. She says she feels "disconnected" and "left behind" when it comes to technology. The one communication technology she uses avidly, however, is her Blackberry phone, which she uses not only for talking, but also for checking email, using Facebook, and listening to music. Jamar Sr. is an avid sports fan and music listener, and uses the computer to keep up with these hobbies. Given that much of the family's income comes from irregularly timed real-estate transactions, finances heavily influence technology purchasing decisions. When the family experiences technology troubles, they rely on either Jamar Sr. or a few of Jamar Sr.'s friends in order to get technical assistance.

Table 5.11: Lithonia Demographics

	Occupation/ Education	Has technical training or self-describes as technically inclined	Describes self as a technical enthusiast	Approach to technology problem solving and maintenance
Jamar 31-40 /M	Real estate finance/ Some college	Yes	Yes	Use of professional support services: telephone support lines (sometimes), in-store repair service (rarely) Asking social network: Deedra (rarely), remote family member (most of the time), friend (nearly all the time) co-worker (sometimes) Self-help: Internet forums (sometimes), figure things out by self (rarely)
Deedra 31-40 / F	Paralegal & real estate agent/ Undergraduate	No	No	Asking social network: Jamar (nearly all the time) Self-help: figure things out by self (some of the time)
Jamar Jr. 2/ M	N/A – Too young to participate			

5.7.7. **Smyrna/Concord**

Jessica Smyrna and Spencer Concord are couple in their thirties who got married during the course of the study. Spencer is a technical enthusiast and self-described "gadget guy" who works as a database administrator. Jessica, while using technology primarily out of necessity, is comfortable with setting up and maintaining technology. However, she chooses not to perform maintenance tasks because Spencer enjoys completing them much more. Both Spencer and Jessica use laptops provided by their employers. Furthermore, Jessica travels frequently for work and relies heavily on her workplace's technical support for questions and problems while away from home. During the course of the study, the couple was preparing to move out of their current residence and into another home.

Table 5.12: Smyrna/Concord Demographics

	Occupation/ Education	Has technical training or self-describes as technically inclined	Describes self as a technical enthusiast	Approach to technology problem solving and maintenance
Spencer 31-40 / M	Database administrator/ Undergraduate	Yes	Yes	Use of professional support services: telephone support lines (sometimes), in-store repair service (sometimes), in-home technician visit (rarely) Asking social network: Jessica (rarely), remote family member (sometimes), friend (most of the time), co-worker (nearly all the time) Self-help: Internet forums (nearly all the time), figure things out by self (most of the time)
Jessica 23-30 / F	Corporate Continuing Education Trainer/ Undergraduate	No	No	Use of professional support services: telephone support lines (nearly all the time) Asking social network: Spencer (nearly all the time), friend (nearly all the time), coworker (nearly all the time) Self-help: Internet forums (nearly all the time), figure things out by self (sometimes)

Table 5.13: Woodstock/Hames Demographics

	Occupation Education	Has technical training or self-describes as technically inclined	Describes self as a technical enthusiast	Approach to technology problem solving an maintenance
Cindy / 31-40 F	Adult Education Teacher/ Undergraduate	No	No	Use of professional support services: telephone support lines (sometimes), Asking social network: Matthew (most of the time), remote family member (rarely), friend (nearly all the time), coworker (rarely), Self-help: Internet forums (sometimes), figure things out by self (sometimes)
Matthew 31-40 M	Sales and Management/ Undergraduate	Yes	Yes	Use of professional support services: telephone support lines (sometimes) Asking social network: Cindy (sometimes), remote family member (rarely), friend (nearly all the time), coworker (sometimes) Self-help: Internet forums (sometimes), figure things out by self (most of the time)

5.7.8. **Woodstock/Hames**

Cindy Woodstock and Matthew Hames are a couple in their 30s in which neither person is particularly technically savvy; Matthew's technical interests tend more toward mechanical items than information technologies. Cindy does slightly more of the information technology-related maintenance in the home. An adult education teacher, Cindy receives technical assistance with her laptop from students in her program who are technically skilled. Both Cindy and Matthew also ask a mutual friend who worked in the IT department of a large company for technology advice. At the time of the study, they had recently moved into their neighborhood, and were experiencing difficulties with their newly installed cable Internet connection.

5.8. **Summary**

In this chapter, I presented the design of a multi-week study in which ten families[11] set up, configured, talked about, and used a set of common home electronics and information technologies that prior studies have shown to be problematic. I also described the design of a custom piece of software called *Tech Clips*, which was intended to uncover opportunities for unmet needs families may have with respect to technical support of their computers, networks, and electronics. Finally, I described the families enrolled in the pilot and post-pilot study. In the following three chapters, I will describe the data analysis techniques and results.

[11] Including the two homes in the pilot study

6. FAMILY FACILITATION STUDY: RESULTS

In this chapter, I first discuss how householders approached the tasks they were assigned during the study. I provide information about the task, reasons for including in the study, householder performance on each task, and strategies used to complete it. I also discuss how these tasks compared to their normal (non-study) routines, and present data on difficulties encountered. When relevant, throughout this chapter I include discussions of the experiences of the two pilot homes in addition to the eight homes in the main study.

I then discuss how Tech Clips was adopted by homes. I present data about usage patterns over the time of the study, content contributed by householders, and household experiences with recruitment of others to use the software. Overall, the ways in which householders used Tech Clips, and the struggles they encountered with the software differed greatly from what I had expected. At the end of this chapter, I provide a reflection on the thesis statement and research questions and describe how the research approach evolved over the course of the study.

6.1. Week 1 Task Performance

As discussed in Chapter 5, for every week of participation in the study, each household received a set of technology-related tasks to complete. Tasks for Week 1 were intended to be a warm-up with a set of relatively easy tasks that householders could split amongst themselves as they saw fit and complete in any order. During that week, any questions about the study or problems with the software could be addressed. In the following sections, I describe how householders approached each of the tasks in Week 1. A complete list of completion rates for Week 1 is listed in Figure 6.1 and Weeks 2-3 are listed in Figure 6.17.

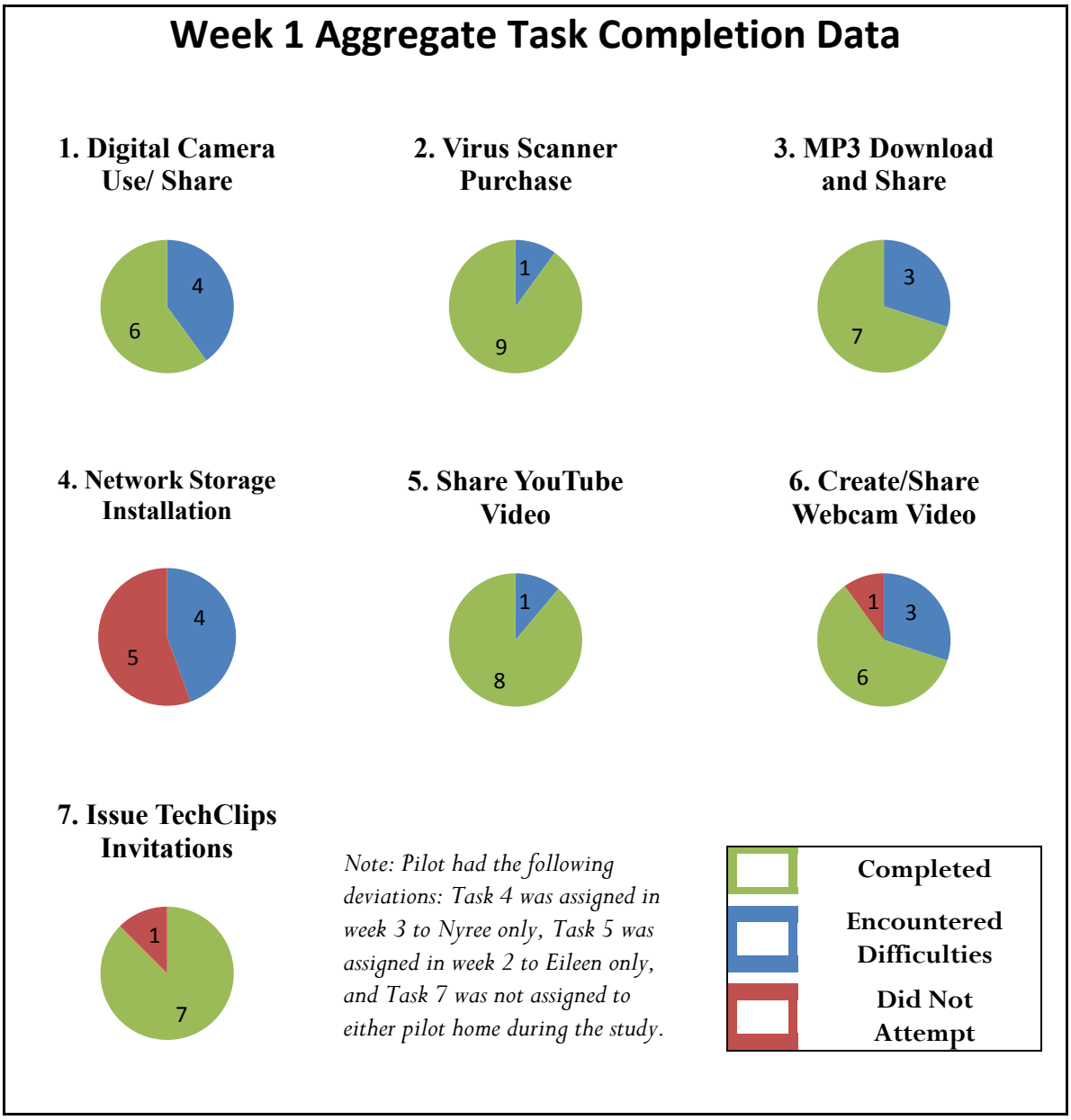


Figure 6.1: Week 1 Task Completion Data for All Households

6.1.1. **Task 1: Sharing Photos**

The first task asked householders to take a set of photos with a digital camera, transfer them off the camera, and share them with someone else. This task was chosen for two reasons. First, digital photography is a familiar task for home consumers, and I anticipated it would be a familiar and

potentially enjoyable task for acclimating participants. Secondly, this single task provided insight into participants' baseline capabilities with several computing concepts: using a camera, transferring files between a peripheral and a computer, transferring files over a network, and controlling access to data. I provided each home with a consumer-level point and shoot digital camera (either a Canon or Kodak brand). The cameras were comparable in functionality, and the specific prompt that householders received was as follows:

> Task 1: Take 10 photos with the digital camera we provided. Transfer the photos onto your computer. Once the photos are on your computer, share the photos online with someone you know who doesn't live with you. Be sure to share them in a way in which no one else can see the photos.

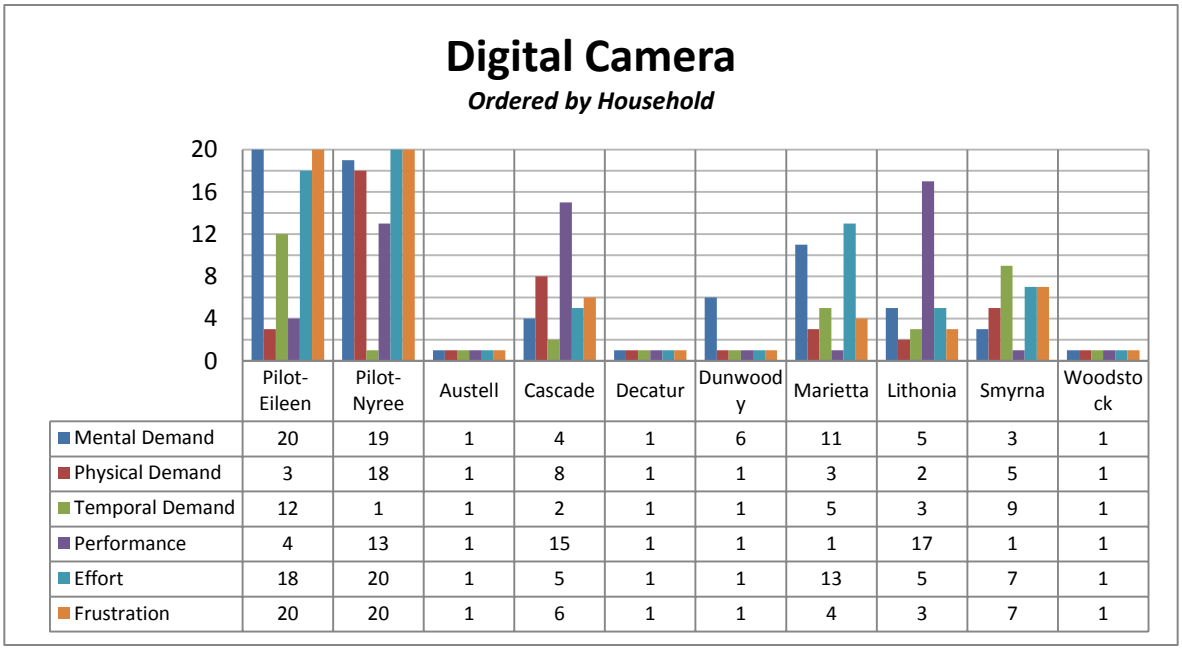
Six homes (Austell, Cascade, Decatur, Dunwoody, Marietta, and Smyrna) successfully completed this task without any difficulties. Kassandra Cascade described minor frustrations in that she could only attach a small number of photos to an email at a time due to file size, but was still able to complete the task; it just took longer than she expected. Spencer Concord (Smyrna Deployment) reported that the biggest difficulty for him was deciding which file sharing site to use. In general, householders already had established routines for photo sharing prior to the study, either using email (Austell, Cascade, Decatur, Roswell, and Woodstock) or online photo sharing services with privacy controls built into the interface (Spencer Concord/Smyrna used Flickr, Roy Marietta used Facebook, and Janine Dunwoody used Picasa). Specific reports of the mental demand, physical demand, temporal demand, performance, effort, and frustrations associated with this task are fully described in Figures 6.2 and 6.3.

Four homes (Lithonia, Woodstock, Pilot-Eileen, and Pilot-Nyree) experienced problems. The women in the Pilot group were completely new to digital photography and file sharing; these participants reported that the task was difficult, mentally demanding, time consuming, and

frustrating. To get assistance in completing this task, Pilot-Nyree called her husband for instructions of what to do; he coached her into sharing photos by email. Pilot-Eileen, with help from her adult son, set up a Facebook account and shared photos over the platform.

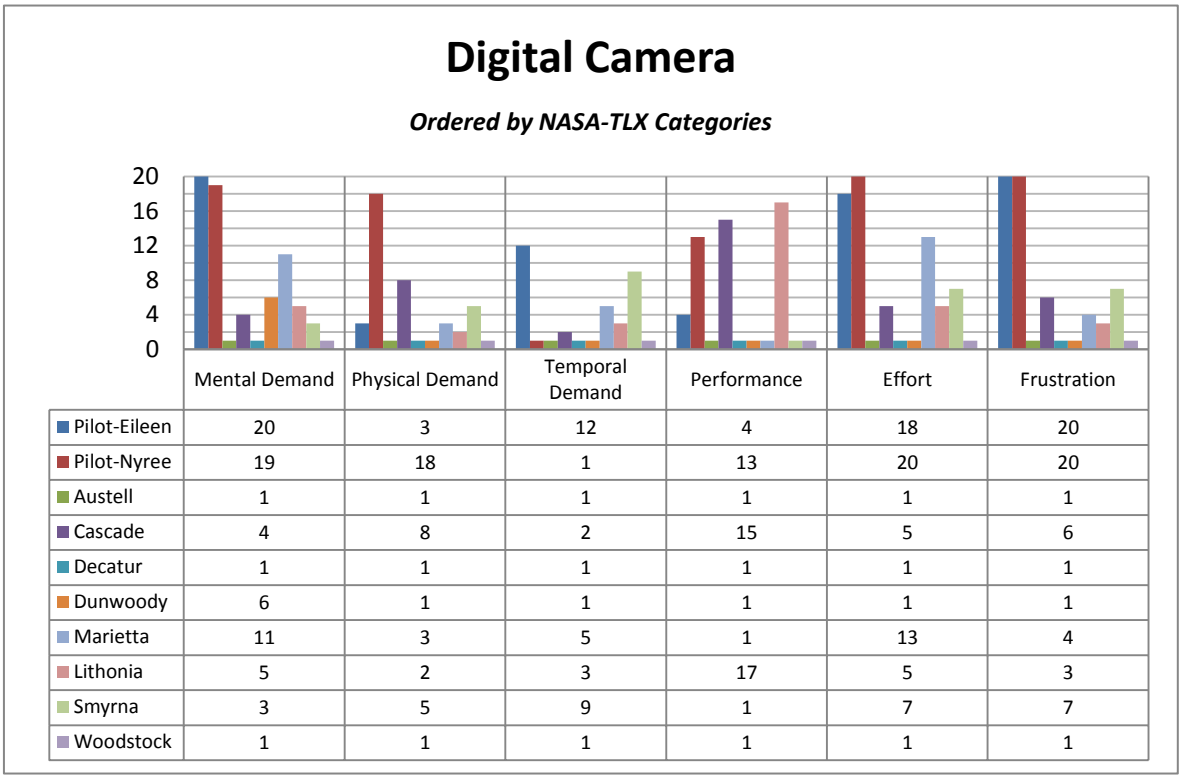
Cindy Woodstock, while confident and experienced with digital photography tasks, experienced problems with file transfer when using the camera we provided. She could not get the camera we provided to be recognized by her computer. To solve this problem, she removed the memory card from the camera, and placed in a USB memory card reader she already owned; this approach allowed her to get the photos onto her computer.

Jamar Lithonia experienced difficulties that point to how the role of being a parent can affect one's engagement with technology. For this task, Jamar took his toddler son to visit a family member who worked at a local fire department. He planned to snap a photo of Jamar Jr. sitting in the driver's seat of a fire truck. However, once they arrived at the fire department, the child was in a fussy mood. Jamar found himself struggling to learn how to operate a new camera while simultaneously tending to his son; he could not divide his attention effectively across both concerns. Instead, he asked to borrow a camera belonging to the firehouse, because the relative could show him how to use it quickly. Once he had the new camera, Jamar was able to take the pictures of his son in the fire truck (who, incidentally, was frowning and crying in each of the photos).



	Pilot-Eileen	Pilot-Nyree	Austell	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock
Mental Demand	20	19	1	4	1	6	11	5	3	1
Physical Demand	3	18	1	8	1	1	3	2	5	1
Temporal Demand	12	1	1	2	1	1	5	3	9	1
Performance	4	13	1	15	1	1	1	17	1	1
Effort	18	20	1	5	1	1	13	5	7	1
Frustration	20	20	1	6	1	1	4	3	7	1

Figure 6.2: Digital Camera Task Performance Ordered By Household



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Pilot-Eileen	20	3	12	4	18	20
Pilot-Nyree	19	18	1	13	20	20
Austell	1	1	1	1	1	1
Cascade	4	8	2	15	5	6
Decatur	1	1	1	1	1	1
Dunwoody	6	1	1	1	1	1
Marietta	11	3	5	1	13	4
Lithonia	5	2	3	17	5	3
Smyrna	3	5	9	1	7	7
Woodstock	1	1	1	1	1	1

Figure 6.3: Digital Camera Task Performance: Ordered by NASA-TLX Categories

6.1.2. **Task 2: A Sick Computer (Virus Scanner Purchasing)**

The second task for Week 1 asked participants to shop for virus scanner software. Through this task, I hoped to learn more about how households made decisions about technology-related purchases, their concerns about computer security, and their normal routines surrounding virus scanning. Participants were given the following prompt:

> Task 2: You know that computer viruses aren't a good thing. Imagine you're going to buy some virus scanning software this week, but you don't want to spend any more than $25 if possible. Research virus scanning software whatever way you think is best, and email info@gthelpstudy.org a message explaining: (1) Which software you would buy; (2) Where you would buy it and why; (3) What the price is for this item

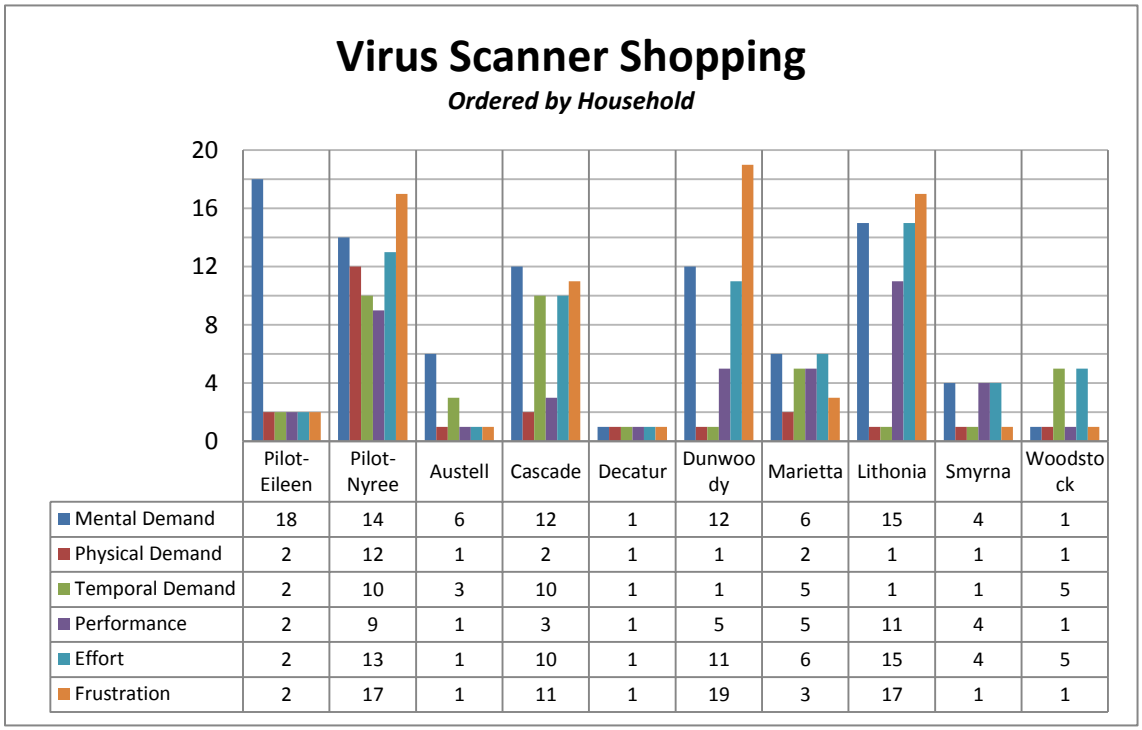
Nine of the ten homes successfully completed this task. The tenth home (Lithonia) attempted to complete the task, but Deedra Lithonia gave up when she became confused about whether it was better to purchase virus scanning software in a brick-and-mortar store or online. Specific reports of the mental demand, physical demand, temporal demand, performance, effort, and frustrations associated with this task are fully described in Figures 6.4 and 6.5.

To complete the task, householders used some combination of the following strategies: asking members of one's social network about the virus scanners that they used (Cascade, Dunwoody, Pilot-Eileen), logging on to each of the computers in the house to check which programs were used (Decatur), drawing on prior personal experiences with security software (Decatur, Marietta), or searching online for product reviews (Pilot-Nyree, Austell, Cascade, Decatur, Dunwoody, Marietta, Lithonia, Smyrna, Woodstock).

Pilot-Nyree, Cascade, Dunwoody, and Lithonia reported high levels of mental demand and frustration with this task; during the interviews they all remarked difficulties distinguishing between software packages, even those offered by a single manufacturer. For example, as of July

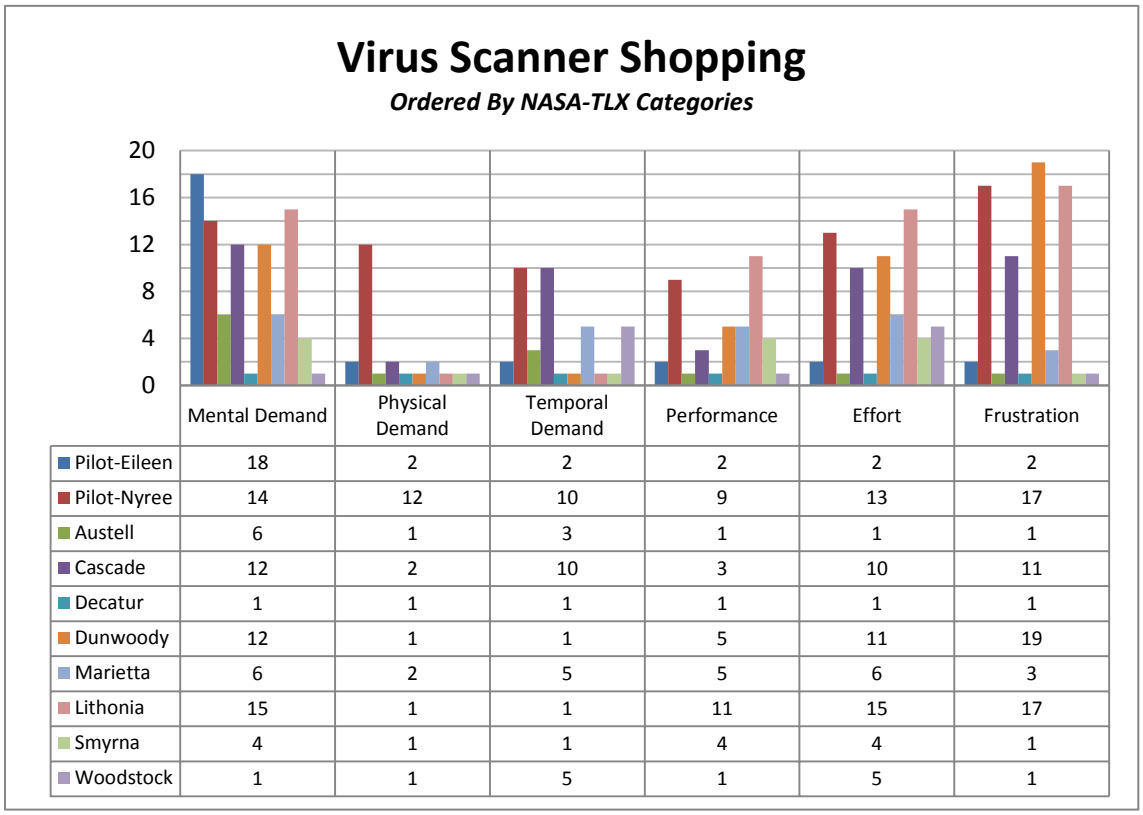
2010, Norton, a popular manufacturer of consumer-grade security software has four versions of their product for PC platforms (Norton 360 Version 4.0 Premier edition, Norton 360 Version 4.0, Norton Internet Security 2010, Norton AntiVirus 2010). How does a consumer decide between these four, plus all of the versions offered by other companies as well?

Some participants turned to consumer-written product reviews (e.g. reviews appearing in web search results, on amazon.com, or on cnet.com). But even with the wisdom of the crowds available, study participants found that there was no obvious best choice; each product on the market had fans and detractors. Thus, participants were left with no clear understanding of which package was best for their needs, and picked one either at random or by which one was the cheapest.



	Pilot-Eileen	Pilot-Nyree	Austell	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock
Mental Demand	18	14	6	12	1	12	6	15	4	1
Physical Demand	2	12	1	2	1	1	2	1	1	1
Temporal Demand	2	10	3	10	1	1	5	1	1	5
Performance	2	9	1	3	1	5	5	11	4	1
Effort	2	13	1	10	1	11	6	15	4	5
Frustration	2	17	1	11	1	19	3	17	1	1

Figure 6.4:Virus Scanner Shopping Task Performance Ordered By Household



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Pilot-Eileen	18	2	2	2	2	2
Pilot-Nyree	14	12	10	9	13	17
Austell	6	1	3	1	1	1
Cascade	12	2	10	3	10	11
Decatur	1	1	1	1	1	1
Dunwoody	12	1	1	5	11	19
Marietta	6	2	5	5	6	3
Lithonia	15	1	1	11	15	17
Smyrna	4	1	1	4	4	1
Woodstock	1	1	5	1	5	1

Figure 6.5: Virus Scanner Shopping Task Performance Ordered By NASA-TLX Categories

6.1.3. Task 3: Name That Tune! (MP3 Downloading and Sharing)

The third task in Week 1 asked participants to download a song from an online merchant and then find a way for others in the home to listen to the music without requiring a personal copy. I chose this task because it involves downloading from an MP3 service with a rather obfuscated interface; I expected that this task might force householders to seek help from outsiders. Furthermore, home media management has previously been noted in the literature as challenging to householders (McDonald *et al.* 2008). Participants were provided with a gift card to download MP3s and the following instructions:

> Think of someone you know. What song reminds you of that person? Use the attached gift card from Amazon.com to download 1-2 MP3s of the song (or songs) that remind you of

```
this person.  Then find a way so other people in your house
can listen to the music file without having to have a
personal copy.
```

Seven out of ten homes successfully completed the download portion of the task without difficulty. Regarding the sharing portion of the task, only *one* participant read the instructions carefully enough. Given the high number of participants who for whatever reason forgot to complete the "share" part of the task, I considered this task complete if they were able to download a song and play it. Specific reports of the mental demand, physical demand, temporal demand, performance, effort, and frustrations associated with this task are fully described in Figures 6.6 and 6.8.

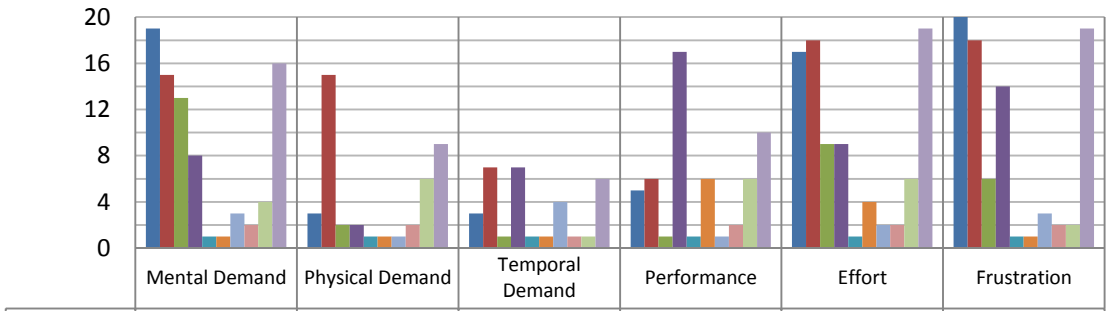
Of the successful homes, having pre-installed software to connect the Amazon MP3 purchasing system with iTunes was one key to a successful experience. In two of the homes, someone had already installed the software. Pilot-Eileen's son had previously installed the software; she had no problems but called him afterward to make sure she completed the task correctly. Steve Dunwoody also had the software installed in advance. Adrian Austell, Jamar Lithonia, and Pilot-Nyree all downloaded the software to connect Amazon to iTunes during the course of the task.

Two successful homes chose not to download the connector software, but as previous Amazon shoppers who were familiar with the website's interface, they were able to navigate the decoupled purchase and download process. Jillian Decatur, who throughout the study was reluctant to download any unnecessary software due to hard drive space concerns, saved the music files to her Windows desktop and then imported them into iTunes. Roy Marietta completed the task cooperatively with his 10-year-old daughter, Justine, letting her select the music and navigate the Amazon.com interface. When it came time to purchase the songs, his only role was to type in

his Amazon.com account username and password. The Mariettas described the experience as "clunky" compared to iTunes, but not unbearable.

Of the homes that had trouble, the Amazon.com website was a source of difficulty. Purchasing songs from Amazon.com is not straightforward, as the transaction of purchasing the song is decoupled from downloading it. This decoupling led Cindy Woodstock to accidentally purchase a song multiple times, but left her without a way to download it. She tried looking at Amazon.com's online help pages for information about how to download her song, but found the instructions confusing. Finally, she called the customer service number on the gift card. Once she was on the phone with the Amazon representative, he coached her step-by-step through the way to get the song onto her computer.

As described in Figure 6.7, Pilot-Nyree used Tech Clips to get assistance with the task through an indirect request for help. She posted the following text, and received a reply from Eileen's son, who also joined the deployment. However, in the time between posting and receiving a reply, she figured out how to complete the task herself. Finally, Viola Cascade attempted to complete the task, but was unable to because the gift card she received had an invalid code on it; I believe I accidentally packed a used gift card into her home's bag.



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Pilot-Eileen	19	3	3	5	17	20
Pilot-Nyree	15	15	7	6	18	18
Austell	13	2	1	1	9	6
Cascade	8	2	7	17	9	14
Decatur	1	1	1	1	1	1
Dunwoody	1	1	1	6	4	1
Marietta	3	1	4	1	2	3
Lithonia	2	2	1	2	2	2
Smyrna	4	6	1	6	6	2
Woodstock	16	9	6	10	19	19

Figure 6.6: Music Downloading and Sharing Ordered By NASA-TLX Categories

Table 6.1: Nyree's Request for Help on Tech Clips

Tech Clips Conversation: Downloads

Nyree (2010-04-03 02:38:39): i am trying very unsuccessfully i might add to purchase these mp3 songs i haven't asked anyone yet but i think i'm going to have to. it keeps putting me all over the place and when i think i put it in the cart there's nothing there very frustrating

Larry (2010-04-03 03:08:56): so your selecting the songs and they arent ending up in the cart?

Nyree (2010-04-03 03:14:01): i had to "save" but somehow the button to save didn't didn't show then i noticed a popup blocker thingy and when i clicked that then it allowed it to download and save. didn't like it much but i checked my music file and it was there so it worked

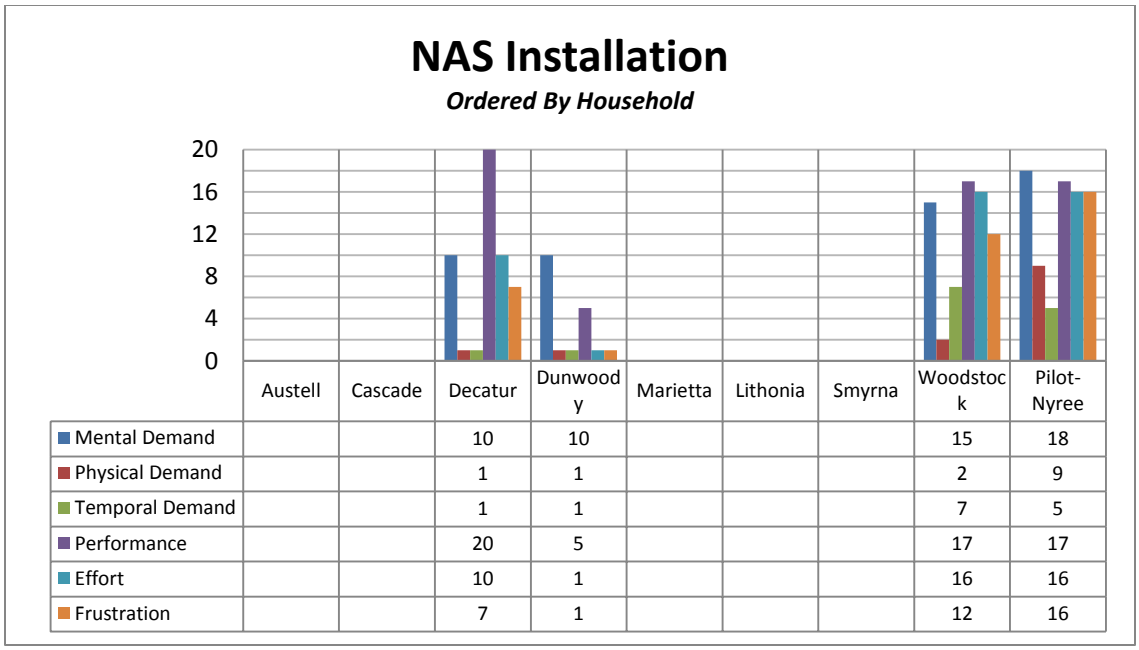
Nyree (2010-04-03 03:18:02): oh about the cart i didn't go back to it once i saw that the pop up thingy solved the problem i have one more to do the photos and i'm done but i'll try that in the morning when i get some sleep good night

6.1.4. **Task 4: File Sharing (Network Attached Storage Installation)**

In Task 4, participants were asked to install a consumer-grade Network Attached Storage Device. They received the following instructions, along with the hardware:

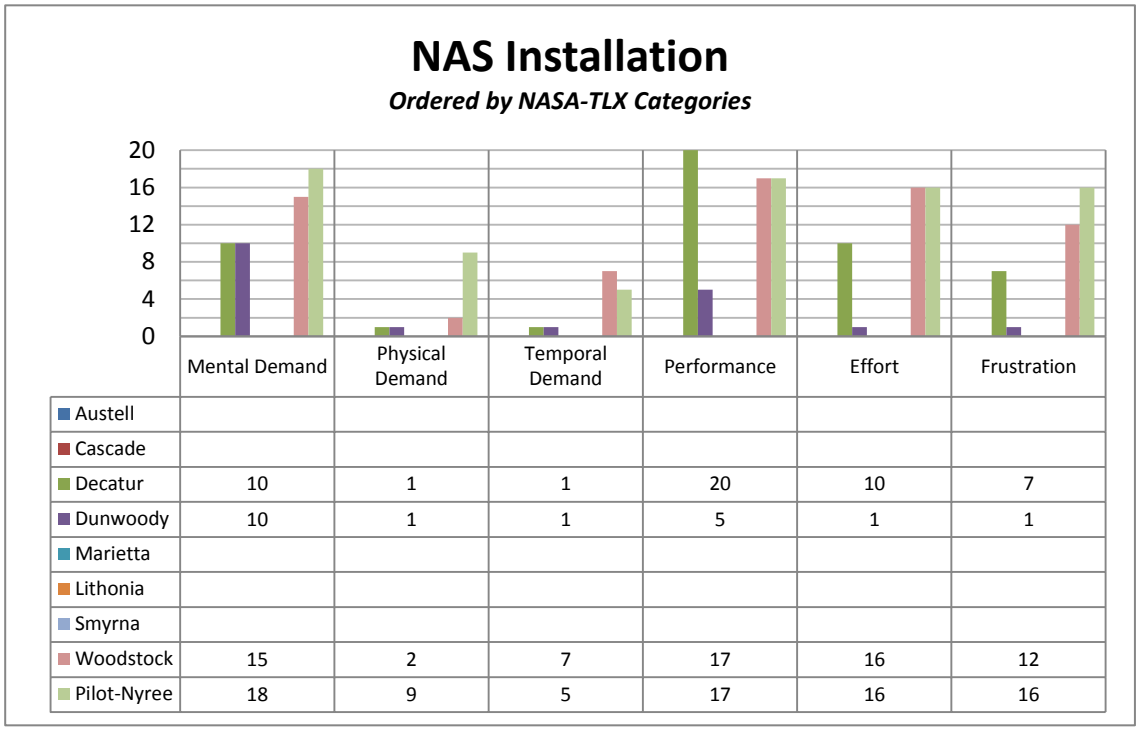
> Sharing files between computers can be a pain. But there are new devices that will let you share files with other computers in your house. You have one in this week's goodie bag. Install the device, and once you have it working, test using it from a different computer. See if you can share the photos you created in Task 1 using this system. When you get file sharing working, put instructions of how to install one of these devices onto Tech Clips.

No home completed this task successfully. The reasons for not completing the task included the following: not having a wireless network (Marietta), not understanding that the device needed to connect to the network's router rather than a computer (Pilot-Nyree), discovering that the home was using the neighbor's wireless connection and their own network was not functioning properly (Woodstock), and mistaking the NAS for a different piece of hardware (Dunwoody, Decatur). The Smyrna and Lithonia homes claimed they ran out of time; Austell and Cascade specifically said they did not understand what the device was and decided not to complete the task. Specific reports of the mental demand, physical demand, temporal demand, performance, effort, and frustrations associated with this task are fully described in Figures 6.9 and 6.10.



	Austell	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock	Pilot-Nyree
Mental Demand			10	10				15	18
Physical Demand			1	1				2	9
Temporal Demand			1	1				7	5
Performance			20	5				17	17
Effort			10	1				16	16
Frustration			7	1				12	16

Figure 6.7: NAS Installation Ordered by Household



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Austell						
Cascade						
Decatur	10	1	1	20	10	7
Dunwoody	10	1	1	5	1	1
Marietta						
Lithonia						
Smyrna						
Woodstock	15	2	7	17	16	12
Pilot-Nyree	18	9	5	17	16	16

Figure 6.8: NAS Installation Ordered by NASA-TLX Categories

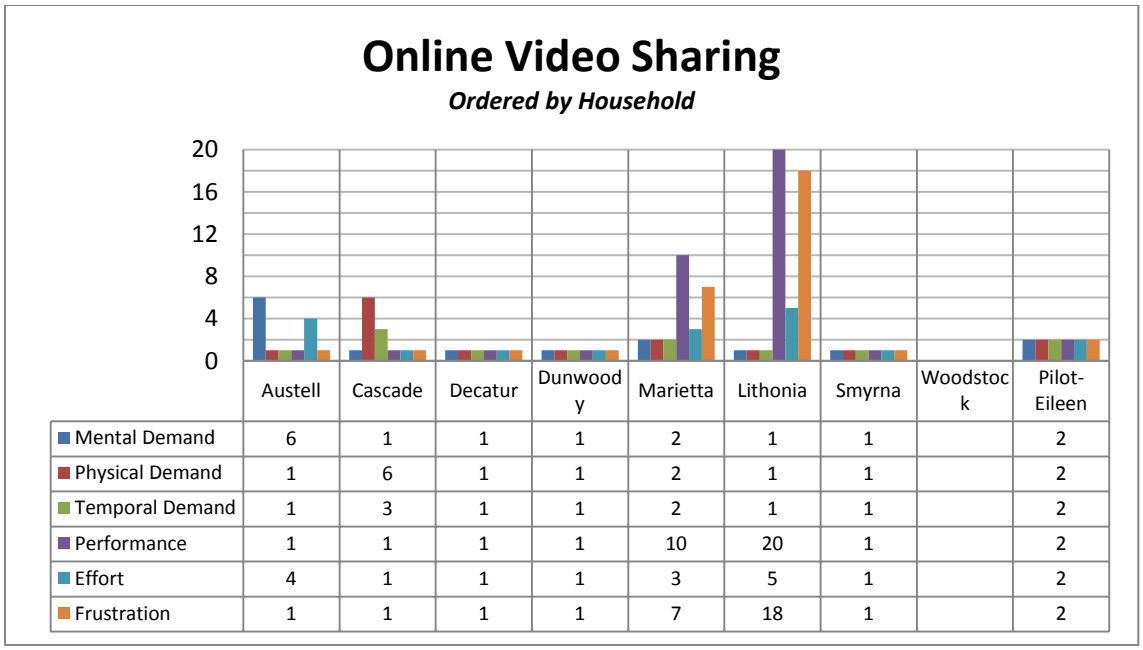
6.1.5. **Task 5: Dancing Babies (Online Video Sharing)**

This task was intended to be very easy and enjoyable, and was included to increase participant interest in the study. In this task, participants found a popular online video and shared it via Tech Clips.

```
After that last task, you might need a good laugh!  Visit
http://www.youtube.com, a website that lets everyday people
share homemade videos with each other.  Find a video with
dancing babies in it (there are a lot of them!), and share
the web address of this video on Tech Clips.
```

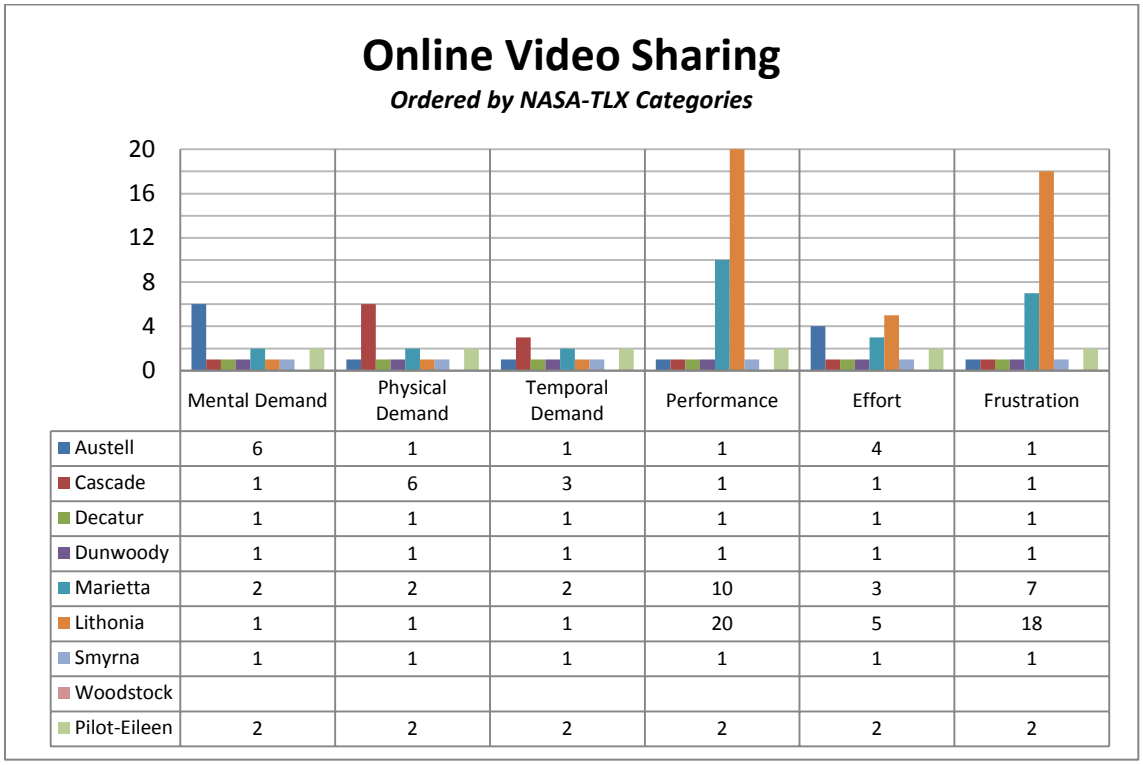
Nine homes in total completed the exercise (Pilot-Nyree did not receive this task). Specific reports of the mental demand, physical demand, temporal demand, performance, effort, and frustrations associated are fully described in Figures 6.11 and 6.12. Note that the Woodstock home completed this task (the link is on Tech Clips) but did not complete the corresponding log book entry.

Of the homes, all were able to complete this task, except for Deedra Lithonia, who had difficulty copying and pasting a link into Tech Clips for reasons unknown; rather than investigating the problem or asking for help, she got frustrated and gave up after it did not work the first time. During the first researcher check-in at the end of Week 1, we discussed this task, and I asked her to show me what she did. Upon the second try, she was able to complete the task successfully. Of the eight successful homes, Roy Marietta mentioned that he found this task "unrewarding" because he did not have anyone else who had joined his Tech Clips deployment; he was sharing the task with himself only.



	Austell	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock	Pilot-Eileen
Mental Demand	6	1	1	1	2	1	1		2
Physical Demand	1	6	1	1	2	1	1		2
Temporal Demand	1	3	1	1	2	1	1		2
Performance	1	1	1	1	10	20	1		2
Effort	4	1	1	1	3	5	1		2
Frustration	1	1	1	1	7	18	1		2

Figure 6.9: Online Video Sharing Ordered By Household



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Austell	6	1	1	1	4	1
Cascade	1	6	3	1	1	1
Decatur	1	1	1	1	1	1
Dunwoody	1	1	1	1	1	1
Marietta	2	2	2	10	3	7
Lithonia	1	1	1	20	5	18
Smyrna	1	1	1	1	1	1
Woodstock						
Pilot-Eileen	2	2	2	2	2	2

Figure 6.10: Online Video Sharing Ordered by NASA-TLX Categories

6.1.6. **Task 6: 21st Century Home Videos (Webcam Video Creation)**

For Task 6, homes were asked to create a short webcam video to share with a friend or family member. The instructions were as follows:

```
Create a webcam video of yourself and send it to a friend
or a family member.  Make sure that they can watch the
video!
```

I had anticipated the householders would use Tech Clips as a way to make these videos, since the software supported video creation and sharing with a closed group of friends; however, householders interpreted this task differently than I had written it, or had trouble with the video recording functionality in Tech Clips. Thus they primarily resorted to another method. Specific reports of the mental demand, physical demand, temporal demand, performance, effort, and frustrations associated with this task are fully described in Figures 6.13 and 6.14.

In the following deployments, there were problems with the webcams and video recording: Pilot-Nyree, Pilot-Eileen, Lithonia, Marietta, and Decatur. Nyree never got video to work on her system, which after seeing other homes in the study, I believe was due to a firewall issue. Eileen was able to get *video* to work, but audio recording via Tech Clips never functioned properly even after trying three different cameras; even so, she made a short silent video clip of herself during the study. Jamar Lithonia also had problems with audio recording working improperly, even after we provided him with several different cameras. To diagnose the problem, he created 15 silent videos testing the camera. Finally, by week 3 he created two videos in which the audio functioned properly, using Deedra's laptop instead of his aging desktop computer. In the Decatur home there were intermittent problems with sound quality – e.g., sound would fade in and out but it is unclear why this occurred. In the Marietta home, the householders could record *audio* but not video. Due to the extensive problems with the cameras in Week 1, all homes with

one of the brands of cameras that were problematic were mailed a higher quality camera with integrated microphone at the beginning of Week 2.

Despite the problems with the cameras during Week 1, every home excluding Pilot-Nyree created videos during Week 1 and throughout the study. Adrian Austell created eight videos over the first week through a number of methods; she primarily used the video recording in Tech Clips throughout the study to share videos of her infant daughter to remote family members. She also created videos via Facebook, and used the camera we provided to make video Skype calls to her family in another state.

The Marietta family also created videos for friends and family. Having experienced difficulties recording over Tech Clips (and no friends or family willing to join the system), they used a standalone piece of webcam recording software in order to record videos for Karen's father. When the videos were completed, they sent the content to him over email. The Mariettas created two videos: one of their daughter, Justine, practicing a foreign language she was studying, as well as another in which the family sang Happy Birthday.

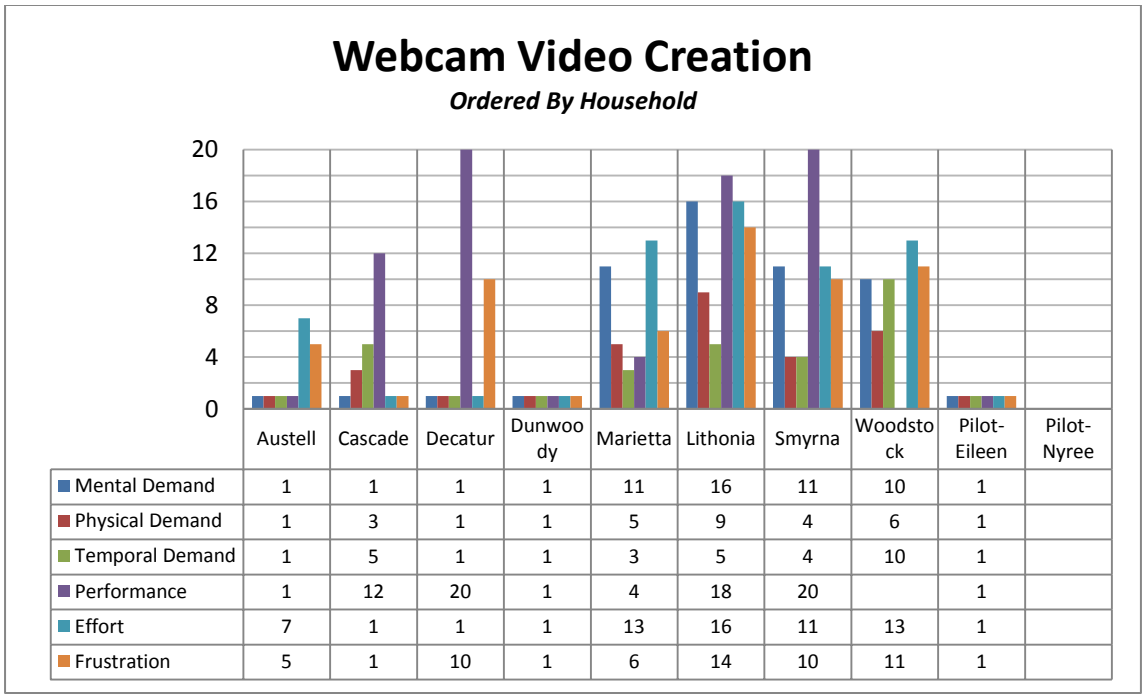
In the Woodstock/Hames home, the couple created a standalone video file of Matthew playing a song on the guitar; they emailed this video to a friend. In the Smyrna/Concord home, Spencer created a short video of his home using standalone webcam software; he interpreted the instructions of the task as requiring video recording from a source *other* than Tech Clips. Also of note in his home is that security software prevented Tech Clips video recording from working easily. He needed to turn off any security software in order to have video functionality in Tech Clips work; note, however, that despite this extra step required for Tech Clips video functionality, he created two test videos using Tech Clips during Week 1.

In the Cascade deployment, Kassandra (the youngest of the three daughters) took responsibility for video creation during Week 1. She created a playful video using Tech Clips for

her older sister; however, she said that she was not satisfied with her experience with this task, as she wanted to create a video using a more powerful program (e.g. Windows MovieMaker) in order to add special effects. However, she did not have any such program and thus used Tech Clips.

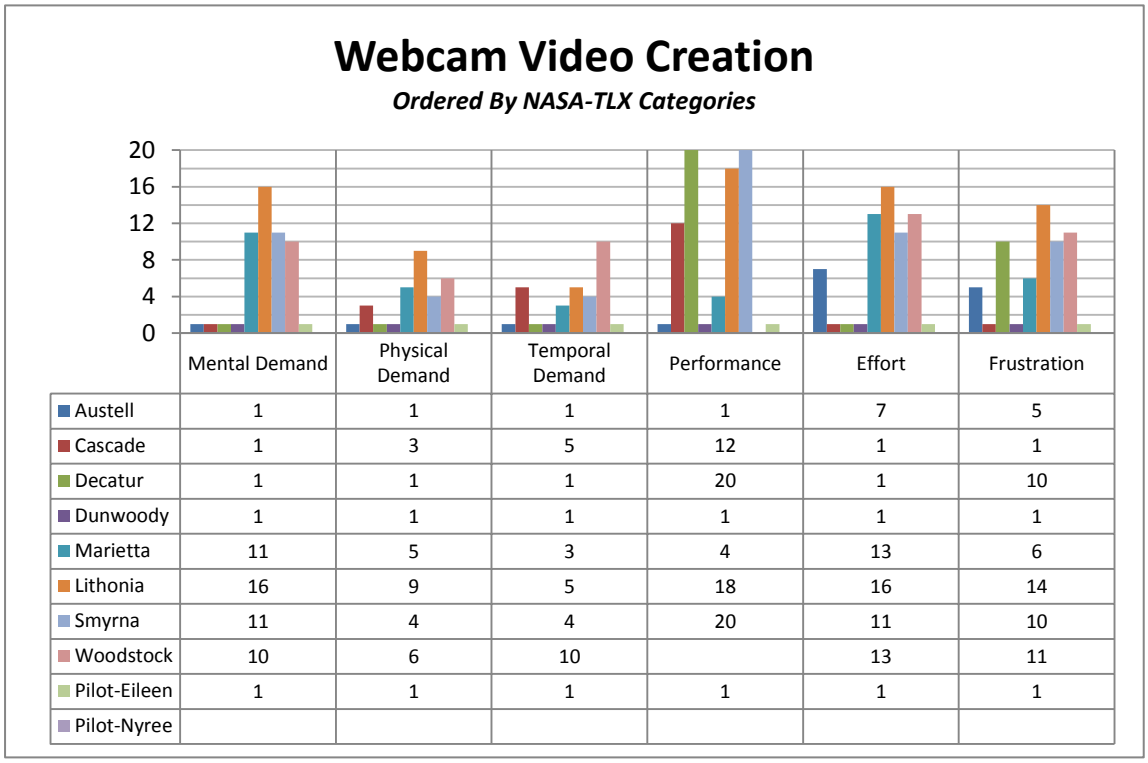
The Decatur family made videos on Tech Clips of their sons pretending to be news broadcasters, and had family members watch the videos in a co-located area (rather than inviting them to watch the videos via Tech Clips on their own computers).

During Week 1, Steve Dunwoody only created test videos during our entry interview session; having a netbook with an integrated camera and microphone, he did not experience any problems with video recording during the study; however, he did not show any overt interest in recording videos using the software. Janine Dunwoody created no videos throughout the study.



	Austell	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock	Pilot-Eileen	Pilot-Nyree
Mental Demand	1	1	1	1	11	16	11	10	1	
Physical Demand	1	3	1	1	5	9	4	6	1	
Temporal Demand	1	5	1	1	3	5	4	10	1	
Performance	1	12	20	1	4	18	20		1	
Effort	7	1	1	1	13	16	11	13	1	
Frustration	5	1	10	1	6	14	10	11	1	

Figure 6.11: Webcam Video Creation Ordered By Household



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Austell	1	1	1	1	7	5
Cascade	1	3	5	12	1	1
Decatur	1	1	1	20	1	10
Dunwoody	1	1	1	1	1	1
Marietta	11	5	3	4	13	6
Lithonia	16	9	5	18	16	14
Smyrna	11	4	4	20	11	10
Woodstock	10	6	10		13	11
Pilot-Eileen	1	1	1	1	1	1
Pilot-Nyree						

Figure 6.12: Webcam Video Creation Ordered By NASA -TLX Categories

6.1.7. **Task 7: You're Invited! (Invite People to Tech Clips)**

The final task of Week 1 was added based on the results of the pilot. In the pilot study, Eileen and Nyree experienced difficulties recruiting participants. Thus, for the remaining eight homes in the study, I provided handouts with cameras, microphones, instructions, and candies that could be given to potential system users. Participants were given the following prompt in their task books:

> Invite at least 5 of your friends or family members to use Tech Clips. You can use the cards or invitation bags we gave you, or you can invite them directly from the software.

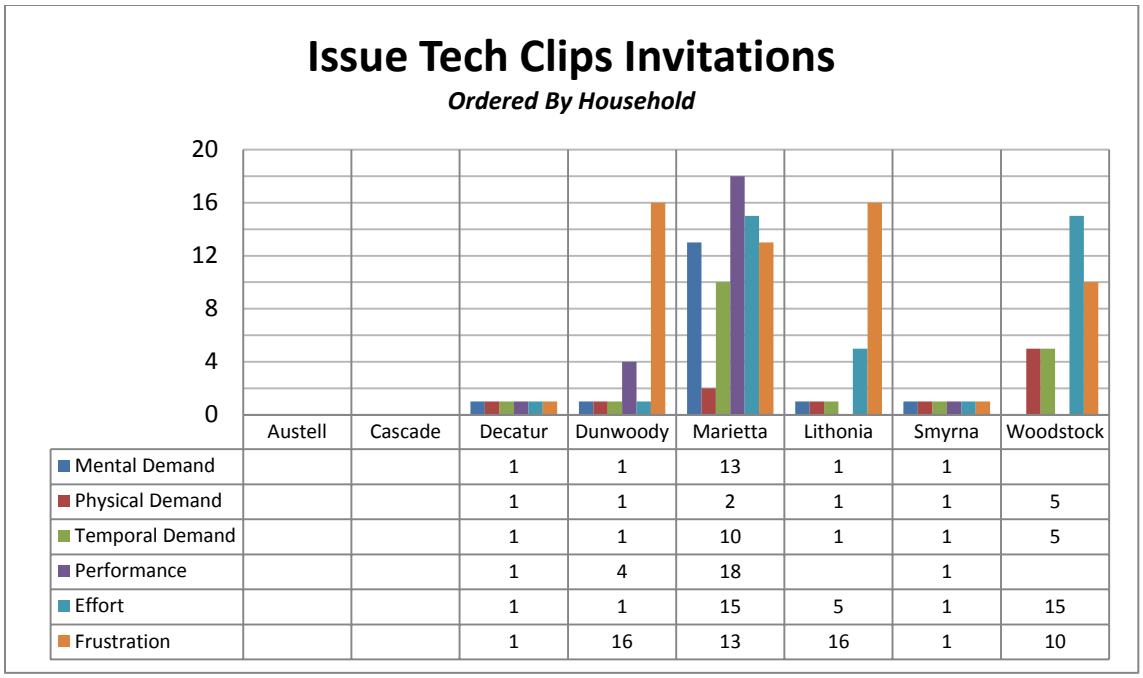
Specific reports of the mental demand, physical demand, temporal demand, performance, effort, and frustrations associated with this task are fully described in Figures 6.15 and 6.16.

Despite my attempts to make it easier for participants to recruit others, recruitment levels were low. The Dunwoody, Marietta, Lithonia, and Woodstock homes reported the recruiting difficulties as frustrating in their task booklets. Four homes (Pilot-Nyree, Cascade, Marietta, and Lithonia) had no luck getting people to join the system. Note however that within the Cascade home, there were enough people in the home that they were able to use the system purely within the home and have an "audience" for their messages.

Jillian Decatur went out of her way to recruit others to use the system. She invited her family living in another state, then passed out paper invitations to friends, neighbors, and people in the PTA at her children's school. Despite her efforts, she had only two people – her sister and mother – join the system. Neither her sister nor her mother contributed any content, either.

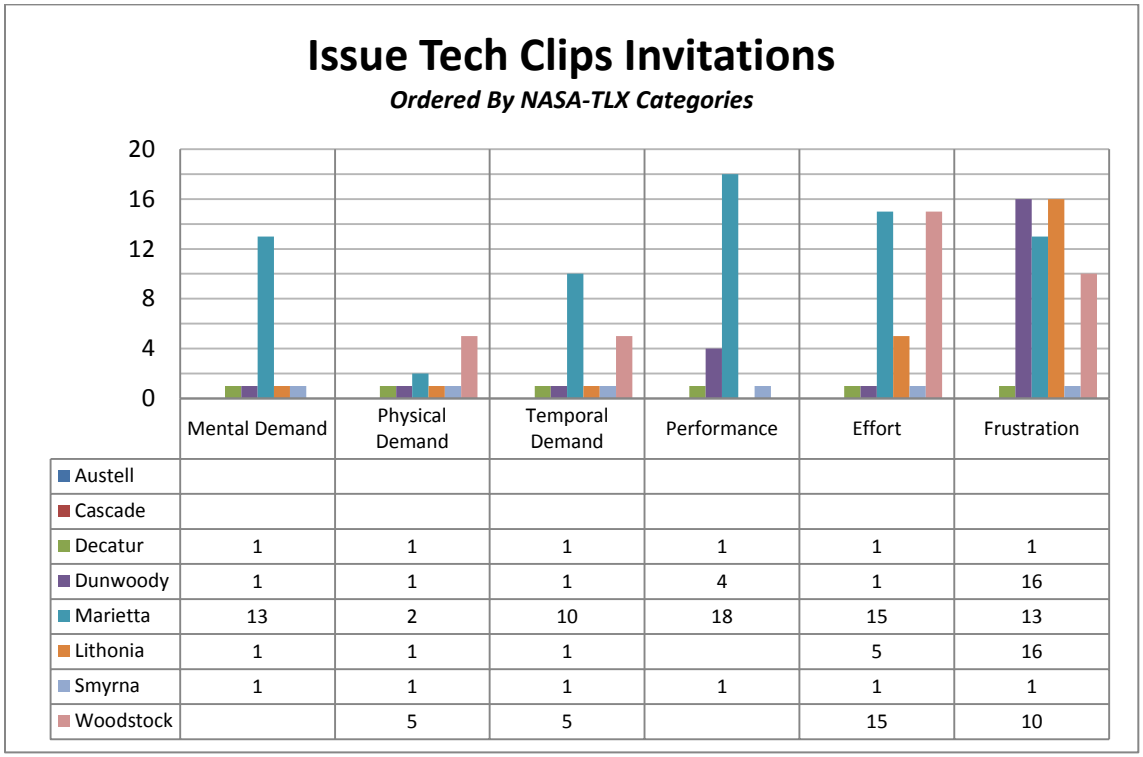
In the Dunwoody household, Janine invited multiple people via the invitation mechanism provided within the software. She also followed up the automatic invitation with a separate, personalized email to explain what the study was and why she wanted them to be involved; she was concerned that a form letter might not be taken seriously by her friends/family. Of the people she

invited, her brother joined. He, too, contributed no content. In the Smyrna/Concord home, Spencer installed the software on his mom's computer for her; however, she did not like the software and asked for it to be removed shortly thereafter. In the Woodstock/Hames household, the couple's parents joined as well as two of Cindy's coworkers, who joined solely to get the $15 Amazon.com gift card promised to invited users who completed a survey at the end of the study. Adrian Austell, who did not complete her logbook page for this task, was the only participant who had the majority of invitees join the system. She invited five people, of which four joined. Adrian's family, however, had a different reason to join the system; the Tech Clips software allowed them to share videos both of Adrian's daughter and the remote participants' children with relative ease. In summary, recruitment was difficult for most households, with the Austell home being an anomaly. At the end of this chapter, I return to a discussion of recruitment issues, and what might be done to remedy them in future software systems.



	Austell	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock
Mental Demand			1	1	13	1	1	
Physical Demand			1	1	2	1	1	5
Temporal Demand			1	1	10	1	1	5
Performance			1	4	18		1	
Effort			1	1	15	5	1	15
Frustration			1	16	13	16	1	10

Figure 6.13: Issue Tech Clips Invitations Ordered By Household



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Austell						
Cascade						
Decatur	1	1	1	1	1	1
Dunwoody	1	1	1	4	1	16
Marietta	13	2	10	18	15	13
Lithonia	1	1	1		5	16
Smyrna	1	1	1	1	1	1
Woodstock		5	5		15	10

Figure 6.14: Issue Tech Clips Invitations Ordered by NASA-TLX Categories

6.2. **Week 2-3 Task Performance**

The tasks in Weeks 2 and 3 mirrored one another; both weeks had tasks that were similar, but with slight variations. In Week 2, the person in the home who identified as being *least* responsible for maintaining the home's technological infrastructure took primarily responsibility for the week's tasks. In homes with more than one person in this role (e.g. Cascade), the people matching this role split up the tasks amongst themselves as they saw fit. During Week 3, the person who identified as being the *most* responsible for maintaining the home's technological infrastructure (even if they were *not* particularly skilled or enthusiastic about technology) took responsibility for the week's tasks. In the following sections, I describe how householders approached each of the tasks.

6.2.1. **Week 2 Tasks for Marietta Only**

Although the recruiting criteria provided to the market research firm specified that homes should have wireless Internet, the Marietta home did not have it. Thus, I added an additional set of tasks during Week 2 for Roy, the occupant who took more responsibility for technology setup and maintenance in the house. Roy was assigned four tasks during the week: to install a wireless router we provided, to configure a laptop we provided to work with the router, to configure a handheld Nokia Internet tablet to use the wireless Internet, and to make a webcam video. Roy installed the router without any apparent problems up front; the laptop would connect to it. However, he could not get the Nokia Internet tablet to connect to the network. He suspected it was a problem with the device, but during the exit interview, we cooperatively discovered that when he installed the wireless router, he had inadvertently enabled a firewall that prevented this item from connecting (along with other wireless gadgets that the family would try out during Weeks 2 and 3). I further discuss the implications of these wireless router configuration issues in Chapter 8.

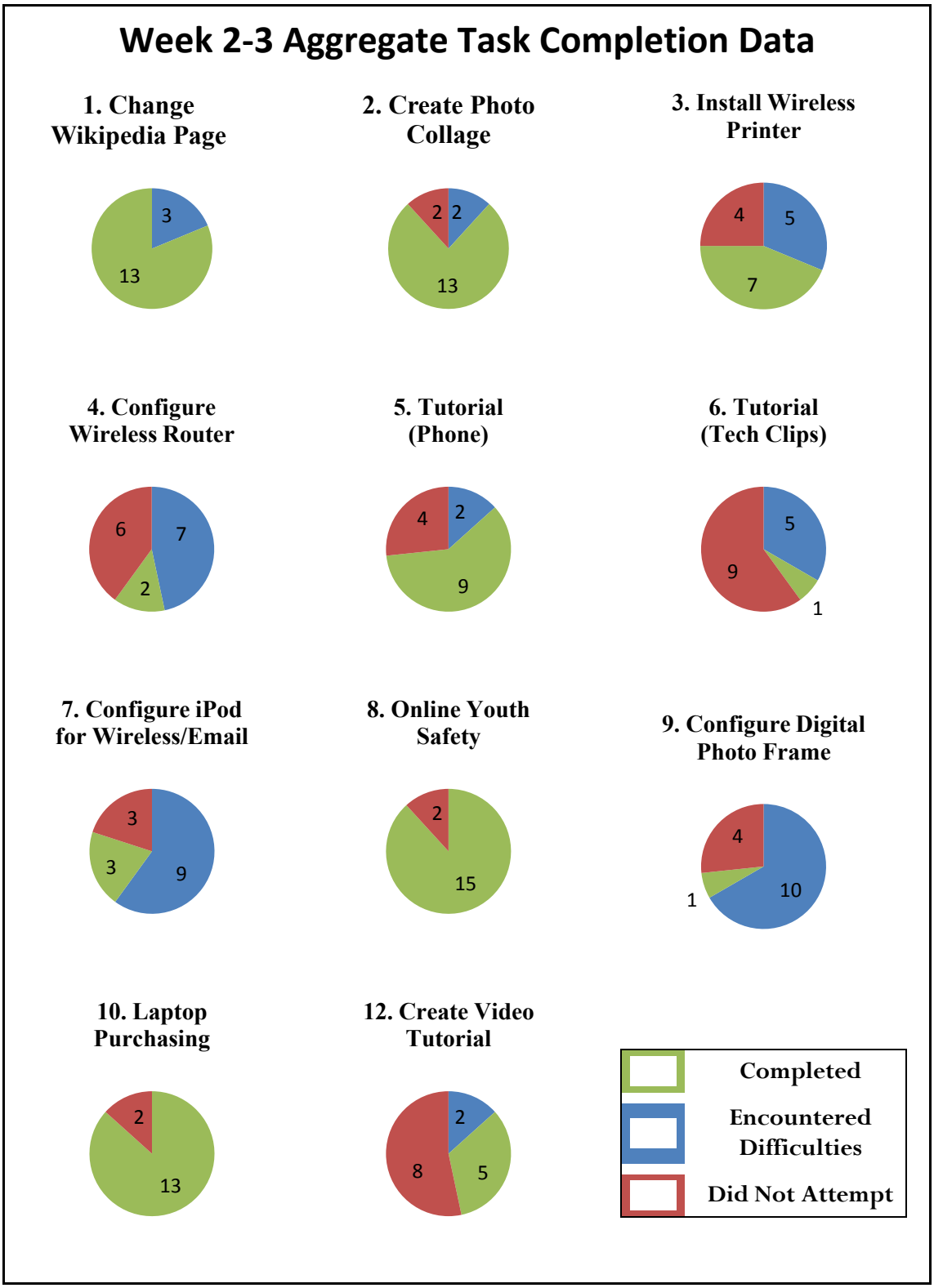


Figure 6.15: Week 2-3 Task Completion Data For All Households

6.2.2. **Task 2.1/3.1: Back In The Day (Edit Wikipedia)**

The first task for the second and third weeks involved searching for content on Wikipedia, the online user-generated encyclopedia, and then making an edit to an entry. I chose this task firstly because I thought it might be enjoyable for participants to reminisce about childhood memories, thus making them more likely to try the task. More importantly, this task could be used as a foundation for tasks later in the week involving participants teaching their family and friends about technology (see Task 2.5/3.5 and Task 2.6/3.6). The instructions provided to participants were as follows. Note that the *content* to be searched is different between weeks two and three, but the method of achieving the task remains the same across both weeks.

> Week two version: Go to the Wikipedia website at www.wikipedia.org. This website is an online encyclopedia that anyone can change. Once you're at the website, search for information about a TV show that you liked growing up. Now try editing the page about the TV show (don't worry, it doesn't have to be anything huge. Just change the wording of a sentence). When you're finished, post a link to the page you changed on Tech Clips.
>
> Week 3 Version: Go to the Wikipedia website at www.wikipedia.org. This website is an online encyclopedia that anyone can change. Once you're at the website, search for information about a toy or board game that you liked growing up. Now try editing the page (don't worry, it doesn't have to be anything huge. Just change the wording of a sentence). When you're finished, post a link to the page you changed on Tech Clips.

Thirteen participants successfully completed the task; and three encountered difficulties that prevented them from completing the task. Of the task completers, Adrian Austell (Week 3) and Keisha Cascade (Week 3) reported that they encountered problems, though they could still complete the task. Keisha tried to edit the entry for Barbie Dolls on Wikipedia, but found that this page was locked from having *anyone* edit it. To overcome this roadblock, she searched for a different toy she had played with as a child. On the other hand, Adrian had difficulty finding the

"edit" tab on the website's interface. Once she found it, she was able to edit the page she selected. Jamar Lithonia, Janine Dunwoody, and Pilot-Nyree, however, were stopped in their tracks during this task. Wikipedia displays the following message to people who edit a page without creating an account first:

> You are not currently logged in. Editing this way will cause your IP address to be recorded publicly in this page's edit history. If you create an account, you can conceal your IP address and be provided with many other benefits. Messages sent to your IP can be viewed on your talk page.12

This message was confusing or concerning to these participants, who did not necessarily understand whether IP address exposure was harmful or innocuous. Similarly, Jillian Decatur, who had contributed to Wikipedia in the past, discussed with us how felt it important to make edits using an account so as to prevent exposure of her IP address.

Of the three non-completers, Nyree described the process of editing an encyclopedia and reading this warning message as something that made her "feel like a criminal." She chose not to save the change she made. Jamar, uncertain about whether exposing his IP address would open him up to harm, called a computer savvy friend to help him interpret this message; his friend told him that he should not complete the task. Janine Dunwoody, too, was alarmed by this message, but decided she did not want to create an account, either, because she did not want to disclose personal information to Wikipedia. If we examine the NASA-TLX data below, we can see that the three non-completers, as well as Adrian, who had trouble navigating the interface rated the task as more demanding, frustrating, and requiring effort to complete.

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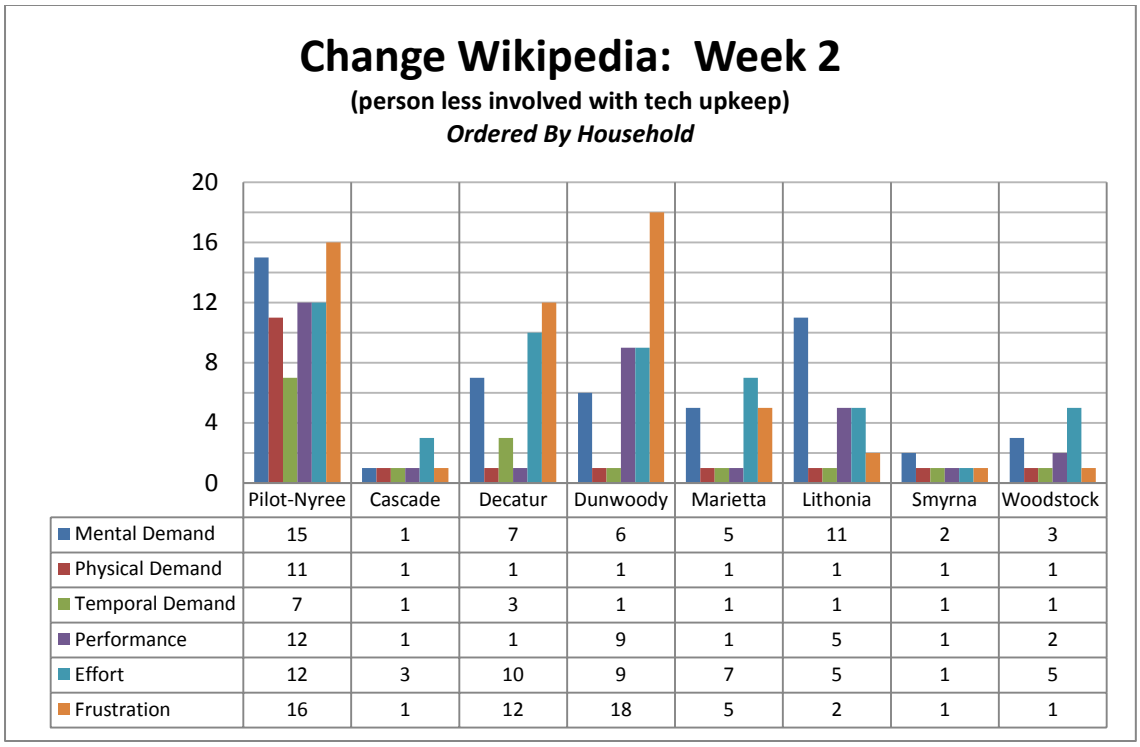
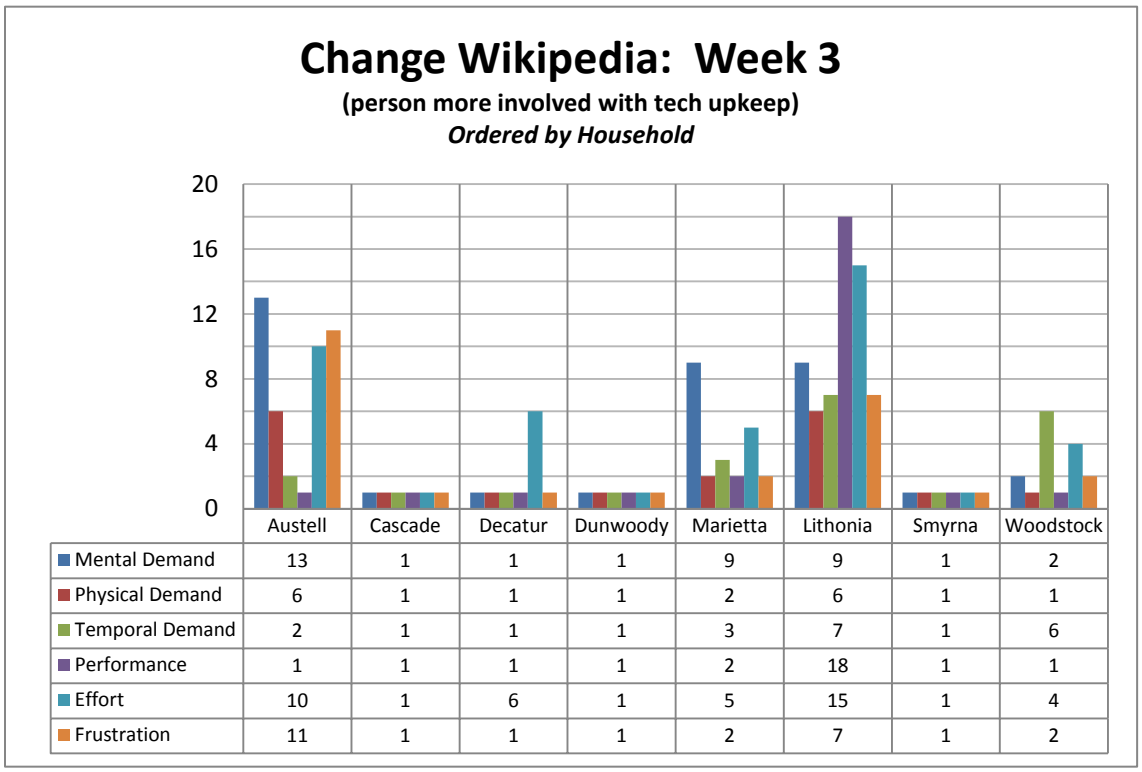
[12] Text obtained from Wikipedia.org as of August 6, 2010.

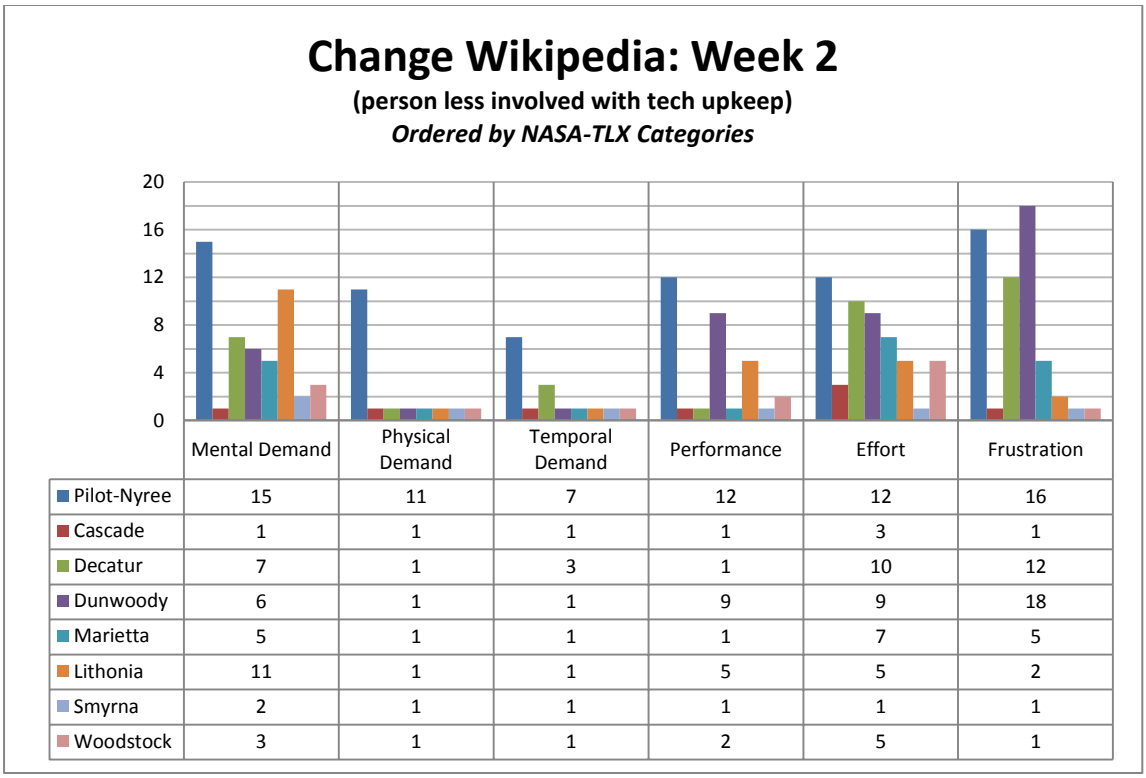


	Pilot-Nyree	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock
Mental Demand	15	1	7	6	5	11	2	3
Physical Demand	11	1	1	1	1	1	1	1
Temporal Demand	7	1	3	1	1	1	1	1
Performance	12	1	1	9	1	5	1	2
Effort	12	3	10	9	7	5	1	5
Frustration	16	1	12	18	5	2	1	1

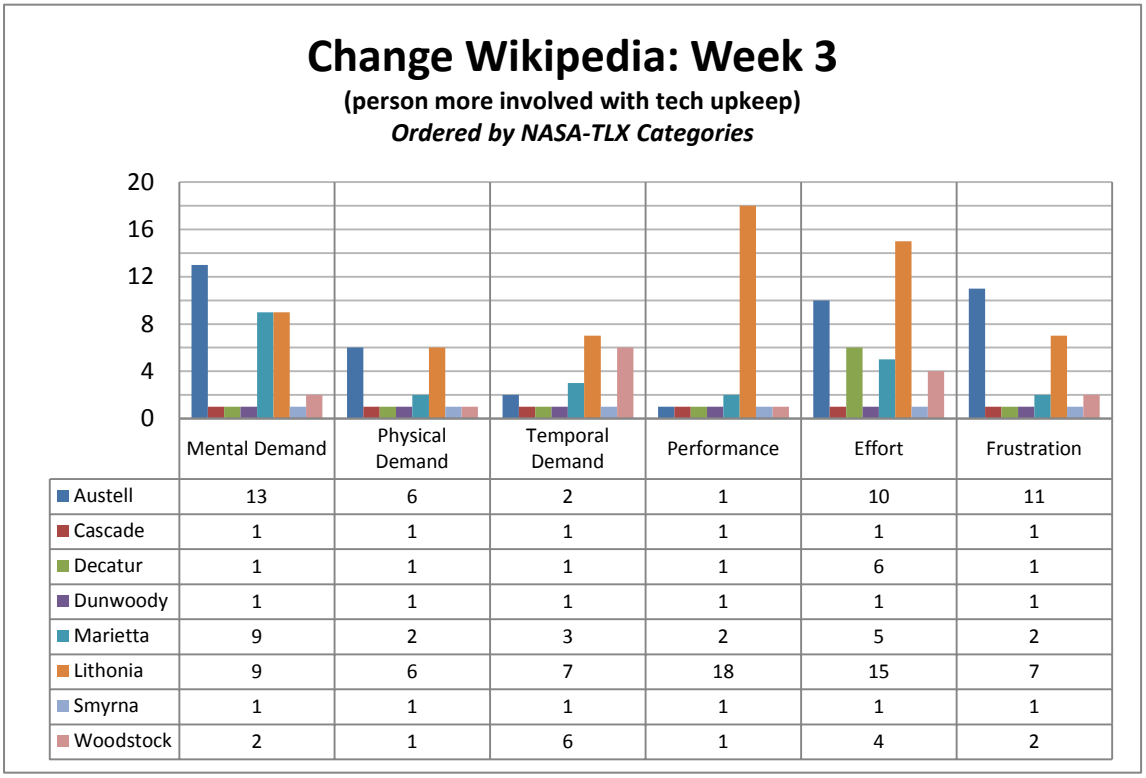


	Austell	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock
Mental Demand	13	1	1	1	9	9	1	2
Physical Demand	6	1	1	1	2	6	1	1
Temporal Demand	2	1	1	1	3	7	1	6
Performance	1	1	1	1	2	18	1	1
Effort	10	1	6	1	5	15	1	4
Frustration	11	1	1	1	2	7	1	2

Figure 6.16: Change Wikipedia Task Performance Ordered By Household



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Pilot-Nyree	15	11	7	12	12	16
Cascade	1	1	1	1	3	1
Decatur	7	1	3	1	10	12
Dunwoody	6	1	1	9	9	18
Marietta	5	1	1	1	7	5
Lithonia	11	1	1	5	5	2
Smyrna	2	1	1	1	1	1
Woodstock	3	1	1	2	5	1



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Austell	13	6	2	1	10	11
Cascade	1	1	1	1	1	1
Decatur	1	1	1	1	6	1
Dunwoody	1	1	1	1	1	1
Marietta	9	2	3	2	5	2
Lithonia	9	6	7	18	15	7
Smyrna	1	1	1	1	1	1
Woodstock	2	1	6	1	4	2

Figure 6.17: Change Wikipedia Task Performance Ordered by NASA-TLX Categories

6.2.3. **Task 2.2/3.2: Getting Crafty (Photo Collage Creation)**

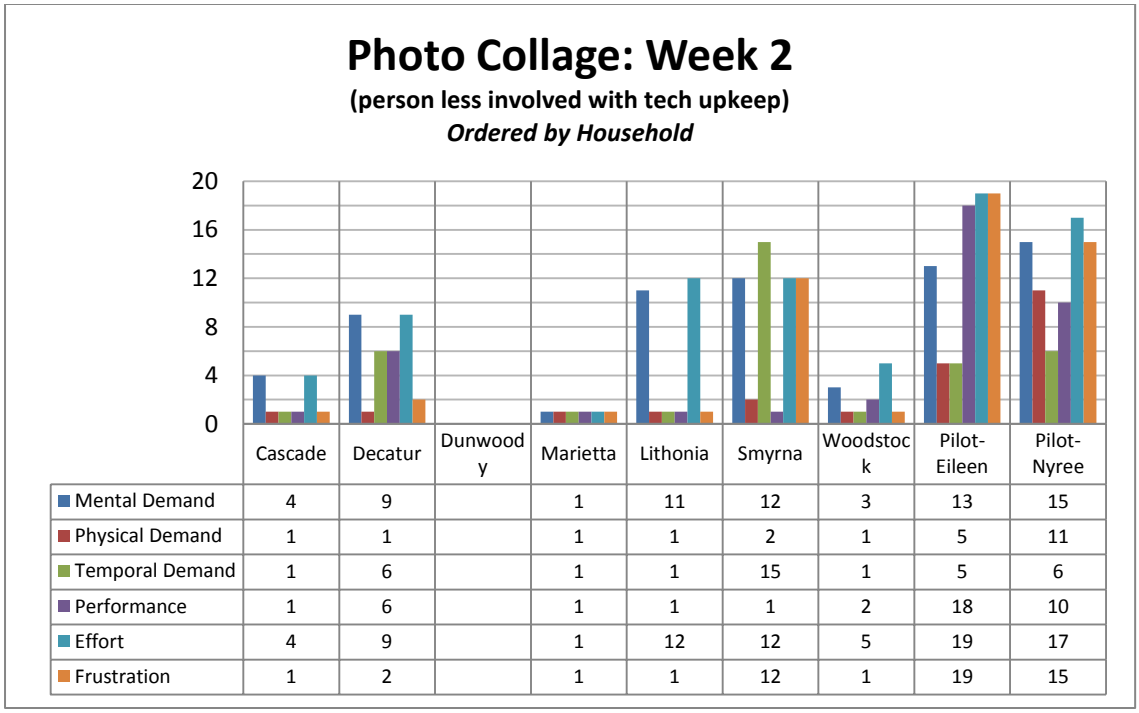
In this task, participants were asked to either create a photo collage using the software of their choice (week 2) or provide instructions on Tech Clips of how to make a photo collage (Week 3). From this task, I had hoped to have participants during Week 3 consult with household members about their experiences during Week 2. From this task, I also learned about participant approaches to downloading software from the web. Participants were prompted as follows:

> Week 2 Version: Remember how someone in your house took some photos using a digital camera during week 1 of the study? Using a computer, pick your favorite photos from that set, and make them into a collage using a photo /image editing program of your choice. If you don't have a photo editing program, you can find free ones online. (PS -If you didn't save the photos, feel free to use some other photos you have). When you're finished creating your design, save the collage, and send it to someone you know by emailing it to them. Also email a copy to info@gthelpstudy.org.
>
> Week 3 Version: Remember how someone in your house took some photos using a digital camera during week 1 of the study? Imagine you were going to make a collage out of those photos. On Tech Clips, post the answers to these questions: 1. What software would you use to make the collage?2. What problems do you think you might encounter when making the collage?3. How would you explain a good way to make a photo collage for someone who's never done it?

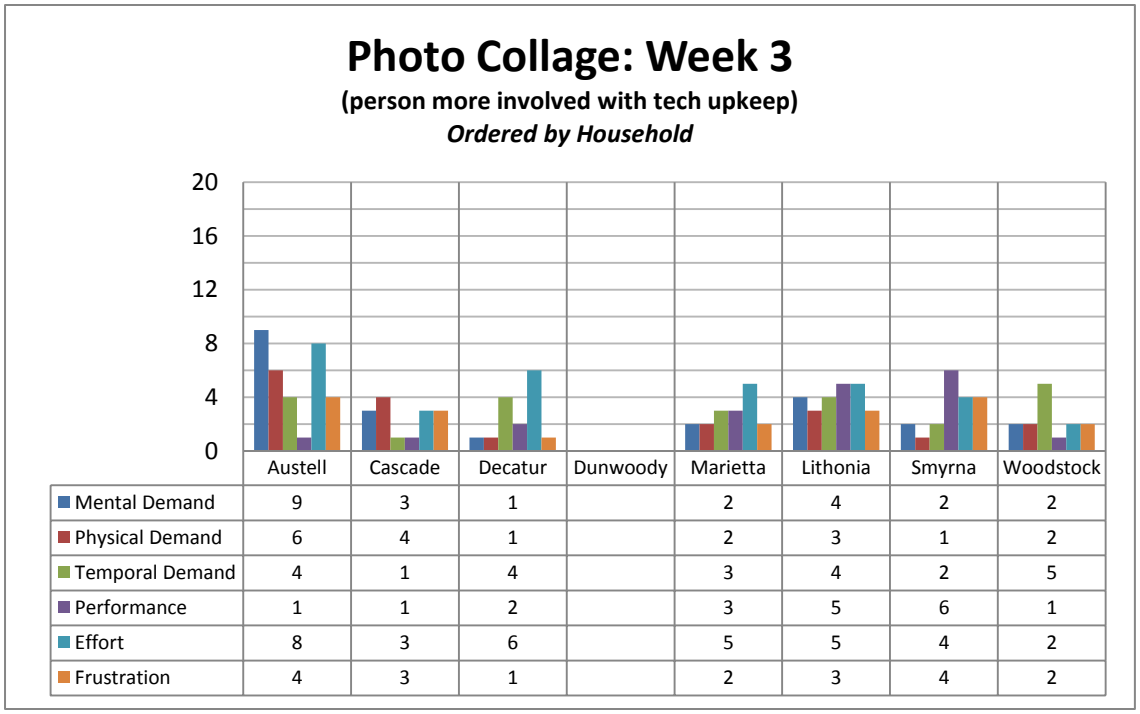
What surprised me about this task is how the people in Week 3 did not read the directions clearly; they did not need to make a photo collage, however in the Cascade, Decatur, and Woodstock homes, the participants created collages in addition to instructions. As one might expect, non-experts found this task more difficult than experts; the Pilot participants, who were the least experienced of anyone in the study had the most trouble. Eileen in the Pilot was unable to complete the task because she could not figure out how to download the software her son recommended. In total, however, most participants reported that this activity was enjoyable, fun, and less effort than they expected. In order to complete this task, participants either used MS Word

(Pilot-Nyree), a photo package that came with their printer (Keisha Cascade), or a piece of software downloaded from the web.

In the Smyrna/Concord home, proprietary file types were problematic; Jessica Smyrna used a piece of collage software that generated files in a proprietary format; thus she was unable to share her collage with others unless they, too, downloaded the program. More broadly, however, I was surprised how, in the context of completing a desirable tasks, participant concerns about security vulnerabilities seemingly disappeared during this task; participants downloaded all sorts of software without questioning who created it or whether it violated their security or privacy concerns. I will discuss the implications of these decisions and opportunities for follow-up research later in this document.



	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock	Pilot-Eileen	Pilot-Nyree
Mental Demand	4	9		1	11	12	3	13	15
Physical Demand	1	1		1	1	2	1	5	11
Temporal Demand	1	6		1	1	15	1	5	6
Performance	1	6		1	1	1	2	18	10
Effort	4	9		1	12	12	5	19	17
Frustration	1	2		1	1	12	1	19	15



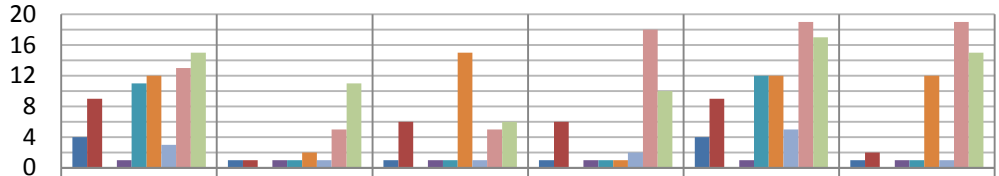
	Austell	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock
Mental Demand	9	3	1		2	4	2	2
Physical Demand	6	4	1		2	3	1	2
Temporal Demand	4	1	4		3	4	2	5
Performance	1	1	2		3	5	6	1
Effort	8	3	6		5	5	4	2
Frustration	4	3	1		2	3	4	2

Figure 6.18: Photo Collage Ordered By Household

Photo Collage: Week 2

(person less involved with tech upkeep)

Ordered by NASA-TLX Categories

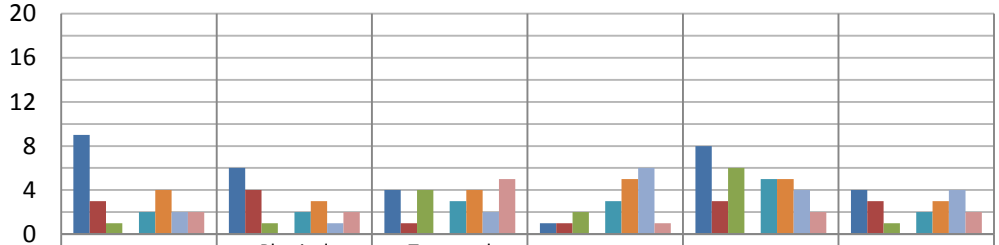


	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Cascade	4	1	1	1	4	1
Decatur	9	1	6	6	9	2
Dunwoody						
Marietta	1	1	1	1	1	1
Lithonia	11	1	1	1	12	1
Smyrna	12	2	15	1	12	12
Woodstock	3	1	1	2	5	1
Pilot-Eileen	13	5	5	18	19	19
Pilot-Nyree	15	11	6	10	17	15

Photo Collage: Week 3

(person more involved with tech upkeep)

Ordered by NASA-TLX Categories



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Austell	9	6	4	1	8	4
Cascade	3	4	1	1	3	3
Decatur	1	1	4	2	6	1
Dunwoody						
Marietta	2	2	3	3	5	2
Lithonia	4	3	4	5	5	3
Smyrna	2	1	2	6	4	4
Woodstock	2	2	5	1	2	2

Figure 6.19: Photo Collage Ordered By NASA-TLX Categories

6.2.4. **Task 2.3/3.3: Going Wireless (WiFi Printer Installation)**

Homes were asked to install a WiFi printer; we distributed either a Canon Pixma MP560 or a Lexmark Z2420 printer. The homes with the Lexmark printer (Pilot-Nyree, Marietta, and Cascade) reported that the installation process was both simple and intuitive. Those who had the Canon printer experienced more trouble with setup. During both weeks, participants received the following prompt:

> Have you ever wanted to print something from a laptop, but didn't want to be plugged into a printer? This week, your bag includes a printer that you can use to print from any computer in your house (without being plugged in or using a USB stick). Install this printer, and print the collage you created in Task 2 from two different computers in your house. Save your printouts in this binder

During Week 3, participants received an additional paragraph of instructions:

> BEFORE YOU BEGIN: If your home successfully completed this task last week, have the person who completed the task last week repack the printer in its original packaging, and remove this printer's settings from all computers in the home.

Participants in three of the homes experienced network problems that prevented the printer from working properly. Jamar Lithonia could only get the printer to work when it was physically plugged in to the computer with a USB cord; strategies such as rebooting the router and re-entering the wireless network key did not lead to problem resolution. The Marietta home also experienced network-related problems; the printer would work on their PC but not on the Mac laptop that connected to their network via a wireless connection. We learned during the exit interview that a router-based firewall was the source of this connectivity problem. In the Decatur home, they also had problems. Neither Jillian nor Mike could get the printer to connect to their network. To troubleshoot the problem, Mike during week 2 physically moved the printer to

different locations in the house, reasoning that he may have had a signal quality problem. During Week 3, Jillian checked to see if her wireless router settings were preventing the printer from working; they could not find the source of the difficulty.

There were also printer successes. The Smyrna home installed the printer in both Weeks 2 and 3. When removing the ink cartridges, however, they complained that ink ended up all over their hands; also, the printer was misaligned and printing documents at an angle. They did not figure out how to fix the misalignment. In the Woodstock home, both Matthew and Cindy were able to install the printer successfully as well.

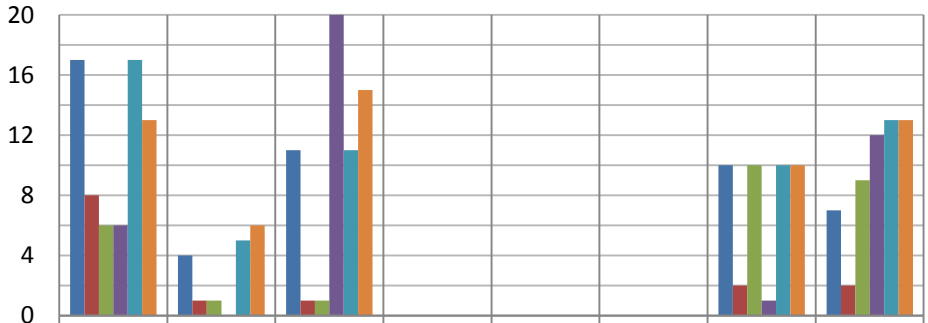
Of the least skilled study participants, Janine Dunwoody and Deedra Lithonia were, to my disappointment, too intimidated to even experiment with setting up the equipment. Yet two other participants with similar levels of technology experience had a much different experience. Viola Cascade also installed her printer successfully. Having never installed computer hardware before, she was proud of her accomplishment, describing it as "liberating" and "empowering." Pilot-Nyree, who also had no experience with hardware installation also described the printer installation in a positive way; she was able to set up the device without having to ask for any assistance. Note that the two homes where the participants were successful were ones in which men did *not* participate in the study; while I cannot say that the absence of men was the reason the women were more positive toward the experience, this preliminary finding suggests an opportunity for future reference on gender, family structures, and digital housekeeping practices.

Marietta attempted this task but did not log it

Install Printer: Week 2

(person less involved with tech upkeep)

Ordered by Household

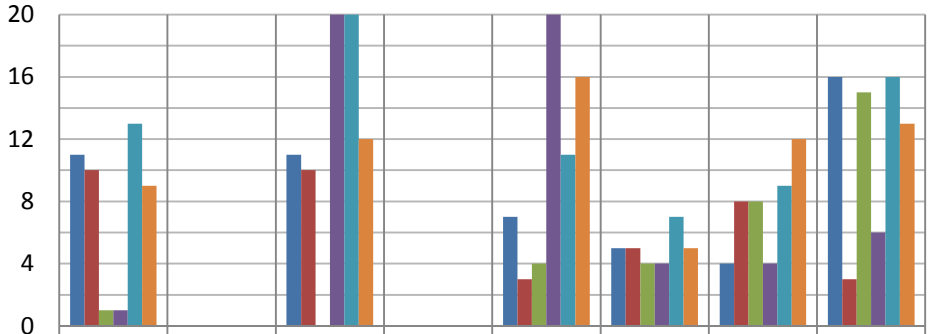


	Pilot-Nyree	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock
Mental Demand	17	4	11				10	7
Physical Demand	8	1	1				2	2
Temporal Demand	6	1	1				10	9
Performance	6		20				1	12
Effort	17	5	11				10	13
Frustration	13	6	15				10	13

Install Printer: Week 3

(person more involved with tech upkeep)

Ordered by Household



	Austell	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock
Mental Demand	11		11		7	5	4	16
Physical Demand	10		10		3	5	8	3
Temporal Demand	1				4	4	8	15
Performance	1		20		20	4	4	6
Effort	13		20		11	7	9	16
Frustration	9		12		16	5	12	13

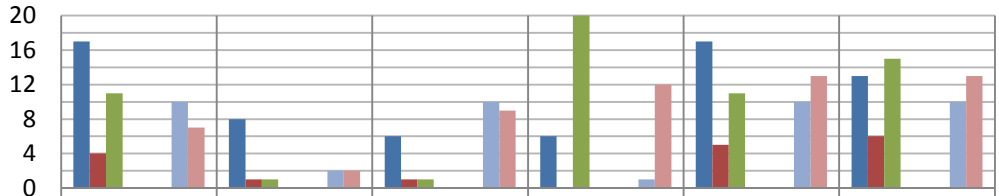
Figure 6.20: Install Printer Ordered By Household

Marietta attempted this task but did not log it

Install Printer: Week 2

(person less involved with tech upkeep)

Ordered by NASA-TLX Categories

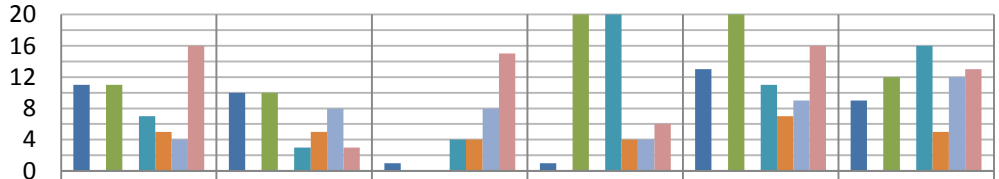


	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Pilot-Nyree	17	8	6	6	17	13
Cascade	4	1	1		5	6
Decatur	11	1	1	20	11	15
Dunwoody						
Marietta						
Lithonia						
Smyrna	10	2	10	1	10	10
Woodstock	7	2	9	12	13	13

Install Printer: Week 3

(person more involved with tech upkeep)

Ordered by NASA-TLX Categories



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Austell	11	10	1	1	13	9
Cascade						
Decatur	11	10		20	20	12
Dunwoody						
Marietta	7	3	4	20	11	16
Lithonia	5	5	4	4	7	5
Smyrna	4	8	8	4	9	12
Woodstock	16	3	15	6	16	13

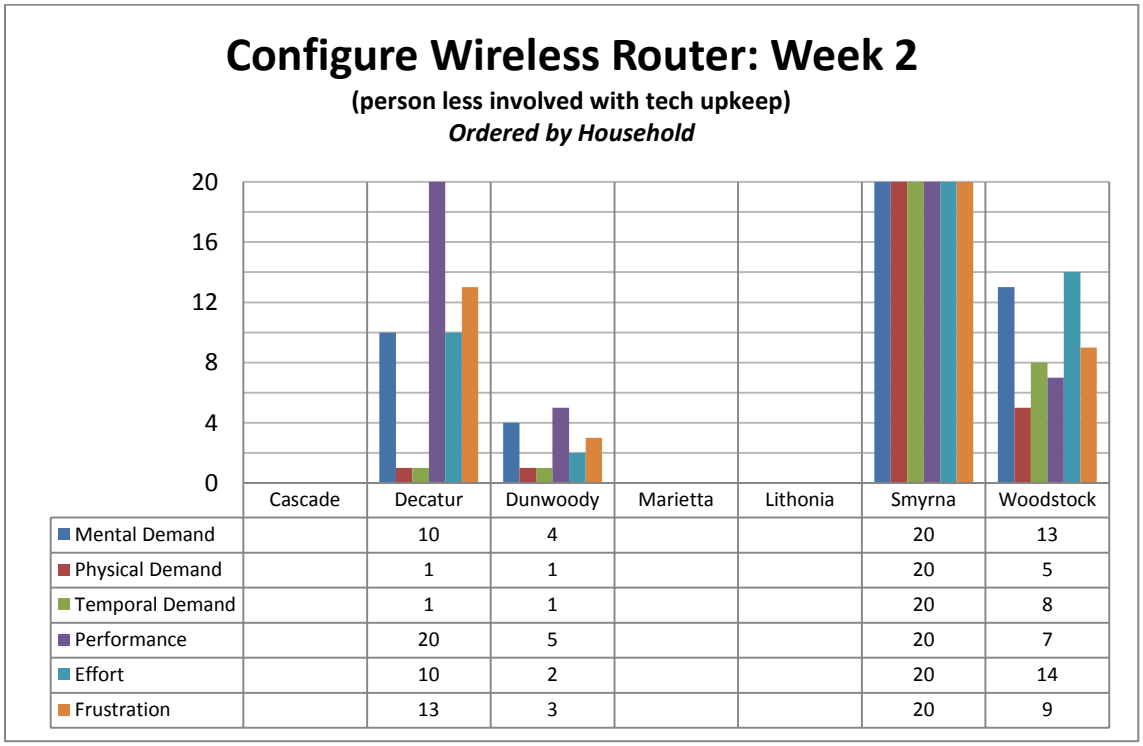
Figure 6.21: Install Printer Ordered By NASA-TLX Categories

6.2.5. **Task 2.4/3.4: Wireless Router Configuration**

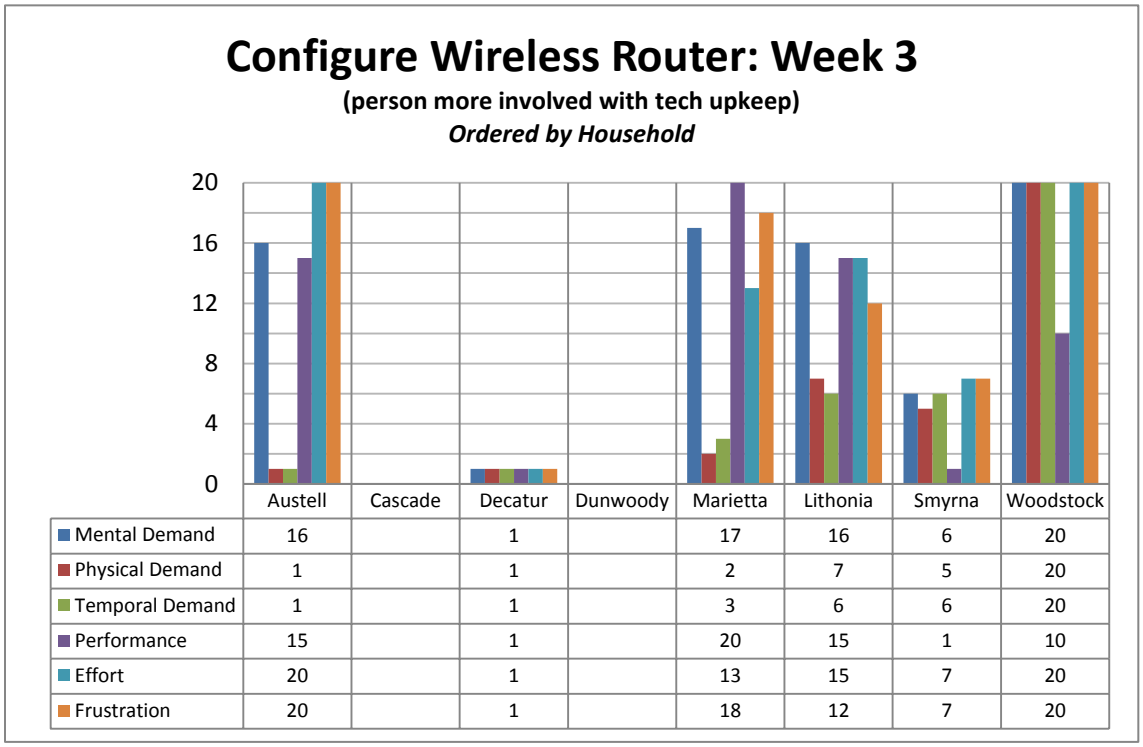
In Task 4, participants were asked to reconfigure the security settings on their wireless routers. During Week 2, participants were asked to add MAC address filtering to their home network; in Week 3, they were asked to change their WEP/WPA key. The prompts provided were as follows:

> Week 2 Version: Your wireless access point (the piece of equipment that lets you use wireless internet) will let you do something called "MAC address filtering." 1.Look online or ask someone you know what MAC address filtering is. 2.Once you know what it is, change the settings on your wireless router so that it uses MAC address filtering. Even if it's difficult, remember to try to do this task yourself!
>
> Week 3 Version: Your wireless access point (the piece of equipment that lets you use wireless internet) will let you do something called "WEP encryption" or "WPA encryption." When you use this, you will have what's called a "WEP key" or "WPA key"1.Figure out which one you have. 2.Write down your key, and then change your key to something else. REMEMBER TO WRITE DOWN THE NEW KEY! 3.Write instructions on Tech Clips explaining what these keys are, and how to change them.

Only two people successfully completed this task. Reasons for not completing the task included technical/usability reasons (e.g. not knowing how to interact with the wireless router), as well as non-technical reasons. For instance, in the Decatur home, neither Jillian nor Mike wanted to make changes because Jillian required availability for her home business; also the home had several laptops and changes would require reconfiguring each of them. In the Lithonia home, Jamar did not want to make changes because he did not want Deedra – who would blame herself for technical problems that were not her fault – upset if the Internet were not working. Specific reports of the mental demand, physical demand, temporal demand, performance, effort, and frustrations associated with this task are fully described in Figures 6.24 and 6.25. For a more in-depth discussion of the challenges of wireless router configuration, please refer to Chapter 8.

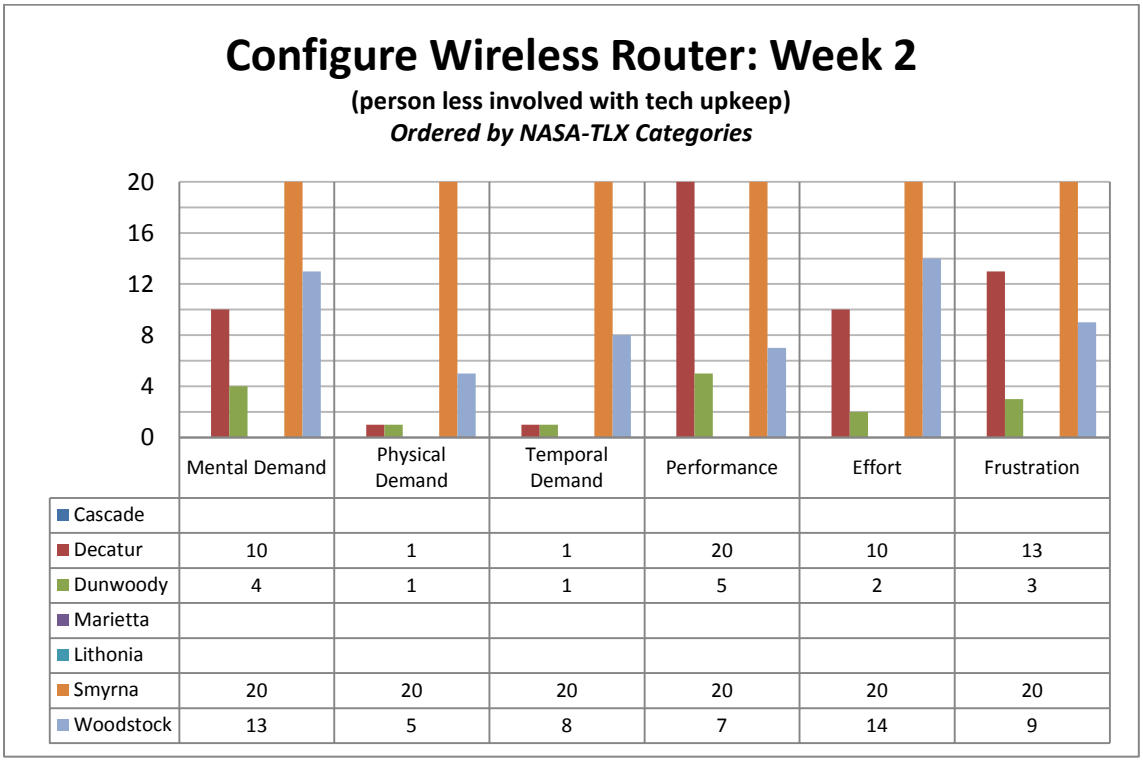


	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock
Mental Demand		10	4			20	13
Physical Demand		1	1			20	5
Temporal Demand		1	1			20	8
Performance		20	5			20	7
Effort		10	2			20	14
Frustration		13	3			20	9

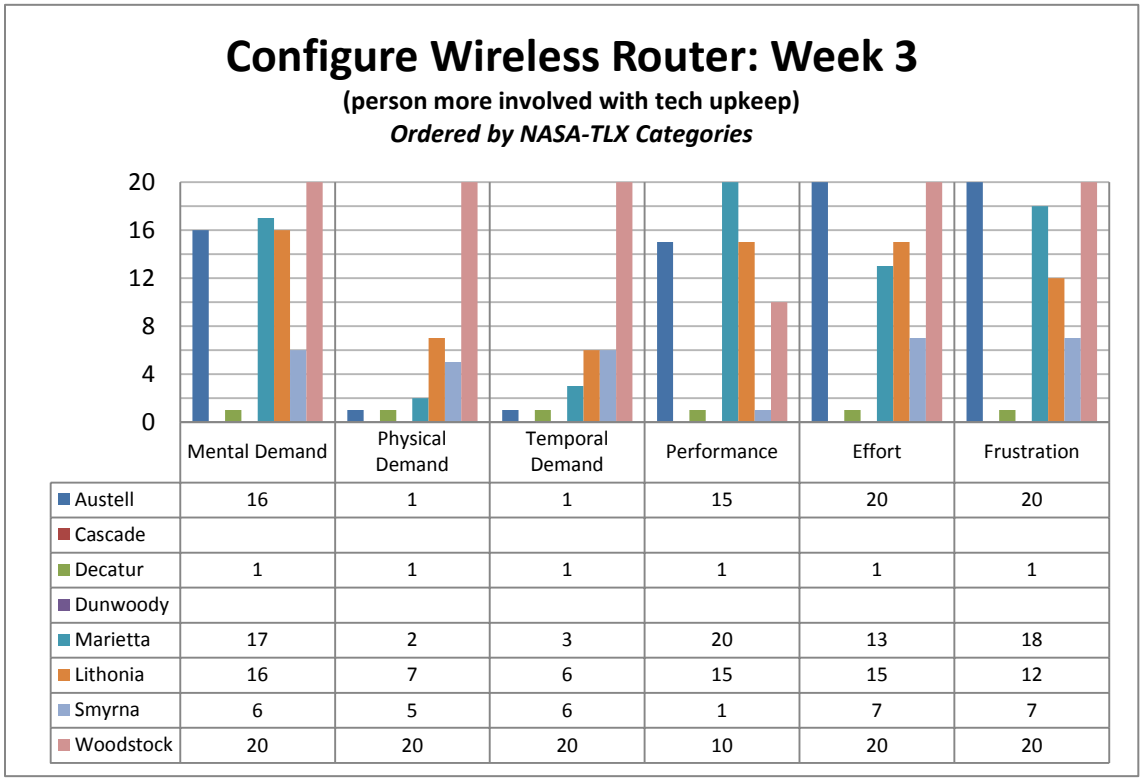


	Austell	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock
Mental Demand	16		1		17	16	6	20
Physical Demand	1		1		2	7	5	20
Temporal Demand	1		1		3	6	6	20
Performance	15		1		20	15	1	10
Effort	20		1		13	15	7	20
Frustration	20		1		18	12	7	20

Figure 6.22: Configure Wireless Router Ordered By Household



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Cascade						
Decatur	10	1	1	20	10	13
Dunwoody	4	1	1	5	2	3
Marietta						
Lithonia						
Smyrna	20	20	20	20	20	20
Woodstock	13	5	8	7	14	9



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Austell	16	1	1	15	20	20
Cascade						
Decatur	1	1	1	1	1	1
Dunwoody						
Marietta	17	2	3	20	13	18
Lithonia	16	7	6	15	15	12
Smyrna	6	5	6	1	7	7
Woodstock	20	20	20	10	20	20

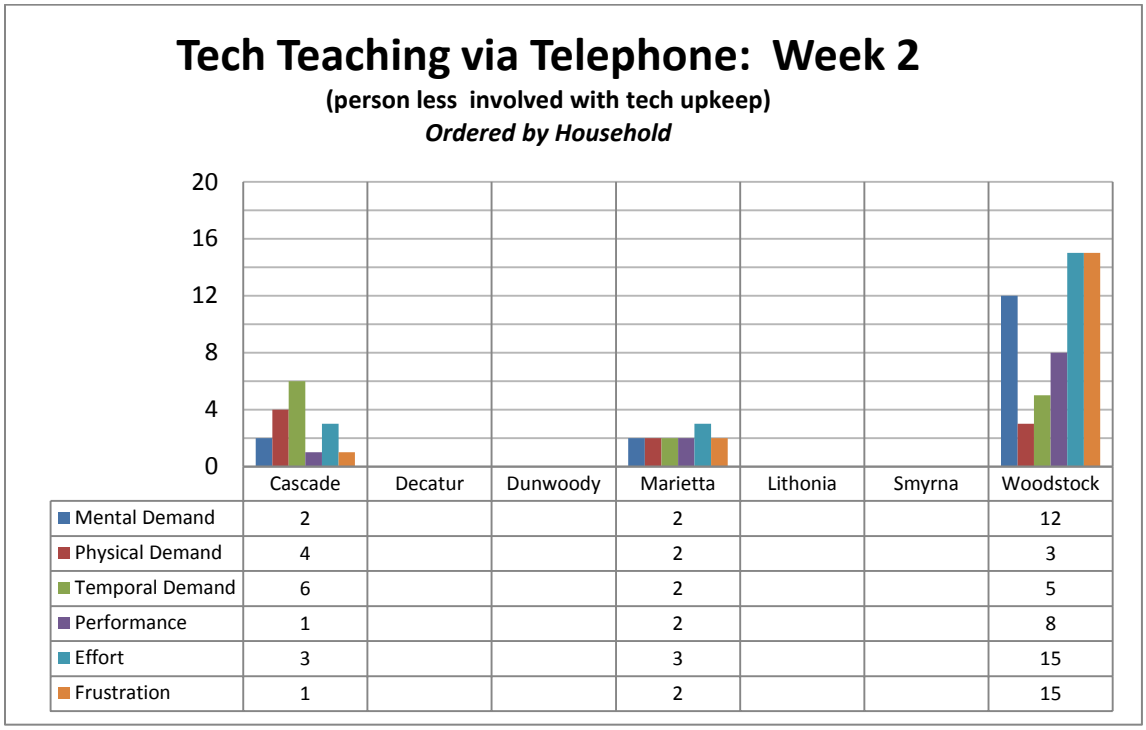
Figure 6.23: Configure Wireless Router Ordered By NASA-TLX Categories

6.2.6. **Task 2.5/3.5: Back in the Day Part 2 (Telephone-Based Teaching)**

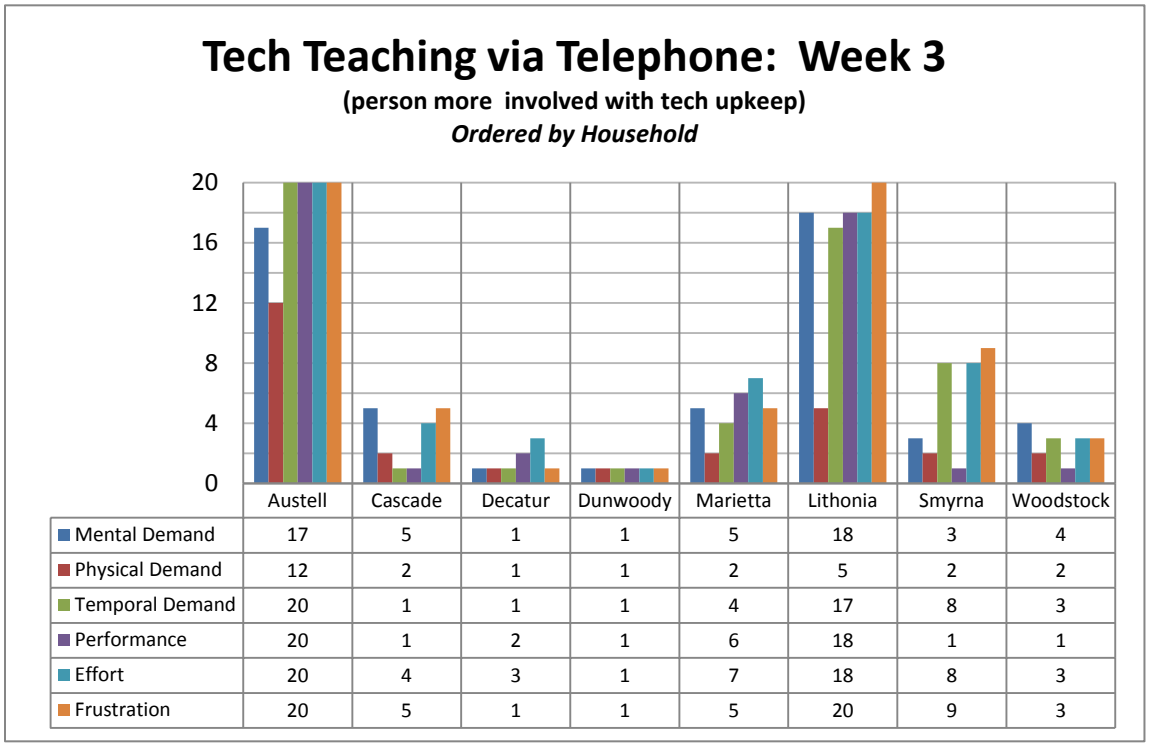
For this task, participants were asked to show off their (potentially) newfound understanding of Wikipedia by teaching someone else how to use it over the phone. Through this task, I hoped to elicit discussion with participants about the opportunities and challenges associated with phone-based teaching and troubleshooting. Participants in Weeks 2 and 3 were provided the following prompt:

> Call up a family member or friend who's not that good with computers. Explain to them what Wikipedia is, and coach them over the phone on how to change information on a Wikipedia page. (Just like you did in the first Back in the Day Task, ask them to change the wording a page about a TV show that they liked when they were younger). When you're finished, post a link to the page that person changed on Tech Clips.

When viewing the charts detailing the participants' NASA-TLX responses for this task, we see a *sharp* divide between the responses of those who opted out of participating in this task. Of the Week 2 (less expert/interested) participants, four of the seven non-gurus assigned this task did *not* complete it. Why did this occur? One reason may be due to self-efficacy. Janine Dunwoody and Deedra Lithonia, for example, both had deeply-held beliefs that everyone they knew was more technically savvy than them, and would not benefit from a tutorial. It's unknown why Mike Decatur did not complete this task.

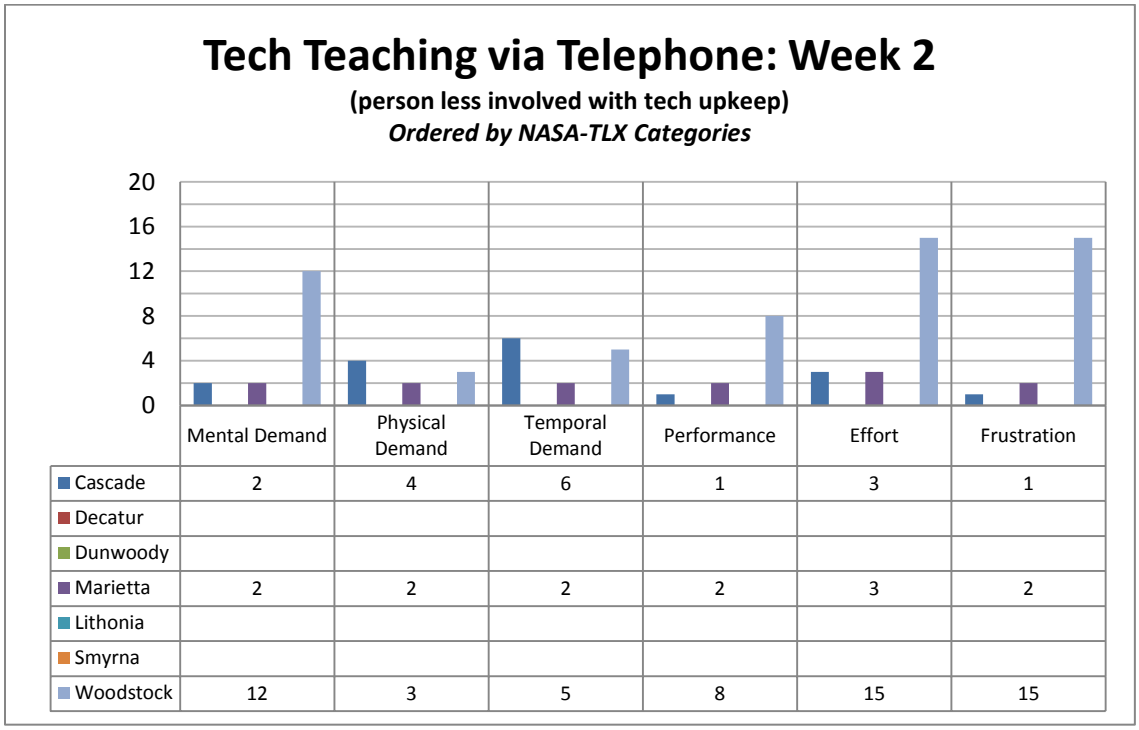


	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock
Mental Demand	2			2			12
Physical Demand	4			2			3
Temporal Demand	6			2			5
Performance	1			2			8
Effort	3			3			15
Frustration	1			2			15

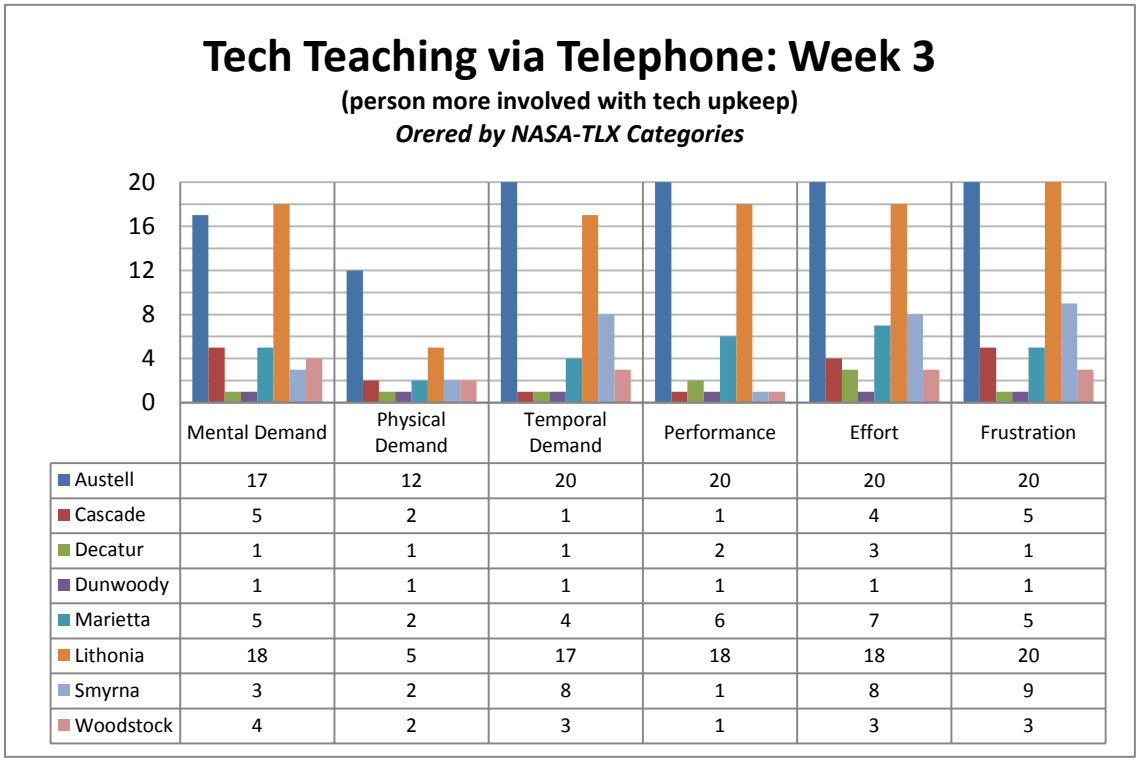


	Austell	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock
Mental Demand	17	5	1	1	5	18	3	4
Physical Demand	12	2	1	1	2	5	2	2
Temporal Demand	20	1	1	1	4	17	8	3
Performance	20	1	2	1	6	18	1	1
Effort	20	4	3	1	7	18	8	3
Frustration	20	5	1	1	5	20	9	3

Figure 6.24: Tech Teaching Via Telephone Ordered By Household



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Cascade	2	4	6	1	3	1
Decatur						
Dunwoody						
Marietta	2	2	2	2	3	2
Lithonia						
Smyrna						
Woodstock	12	3	5	8	15	15



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Austell	17	12	20	20	20	20
Cascade	5	2	1	1	4	5
Decatur	1	1	1	2	3	1
Dunwoody	1	1	1	1	1	1
Marietta	5	2	4	6	7	5
Lithonia	18	5	17	18	18	20
Smyrna	3	2	8	1	8	9
Woodstock	4	2	3	1	3	3

Figure 6.25: Tech Teaching Via Telephone Ordered By NASA-TLX Categories

Jessica Smyrna intentionally chose not to call up her mother, because she had recently had a fight with her about the upcoming wedding to Spencer (which was scheduled to happen at the end of Week 2 of the study). Although this task created an artificial helping situation, Jessica's experience underscores how people may choose not to help family and friends due to a temporary strain on the relationship. Karen Marietta and Kassandra Cascade, in contrast, chose to complete this task with people who they enjoyed speaking with on the phone for social reasons; they reported the experience to be relatively enjoyable.

The majority of participants who completed the task reported frustration and negative experiences. During week 2, Matthew Hames (Woodstock deployment) found it difficult to coach his mother, who was not very skilled with computers into completing the task (however she *did* edit Wikipedia with his help). Each of the week 3 participants had similar responses. Keisha Cascade wrote in her logbook that while she completed the task, "it was a little frustrating because my dad is easily irritated." Similarly, Spencer Concord (Smyrna deployment) wrote in his book:

> I absolutely do not like instructing over the phone. It's frustrating. I don't envy over the phone tech support.

Jamar Lithonia wrote a similarly toned entry:

> I called my Aunt ___. 10 mins to get her online. 40 mins later, she changed a few word, but could not save it. Failure.

Adrian Austell described similar experience as Jamar's. She called a cousin, who she described as "a little slow." This cousin could not understand how to do the task..

6.2.7. **Task 2.6/3.6: Back in the Day Part 3 (Tech Clips-Based Teaching)**

Given the difficulties participants had with teaching family members and friends over the phone, what would their experience be like when using Tech Clips instead? For this task, the following prompt was given during Weeks 2 and 3:

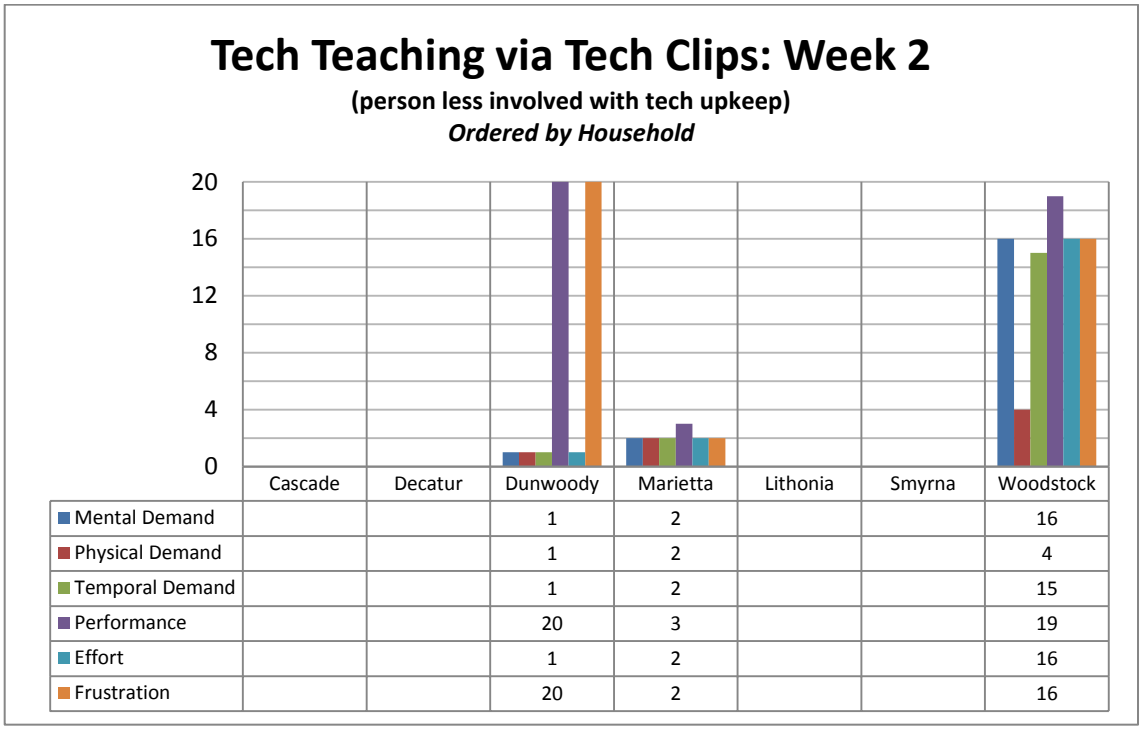
> Now, invite a family member or friend who's not that good with computers onto Tech Clips. Pick a different person than the one you chose for Back in the Day Part 2. Create a new conversation that explains what Wikipedia is, and contains instructions of how to edit a Wikipedia page. Ask them to read these instructions and change the wording a page about a TV show that they liked when they were younger. When they finish this task, ask them to post a link to the Wikipedia page that they changed on Tech Clips.

Across the eight post-pilot homes, three people completed the task each week. In Week 2, Janine Dunwoody wrote a detailed, accurate set of text-based instructions of how to edit Wikipedia. Despite completing the task, she reported the experience as frustrating and unsuccessful, because there was nobody on Tech Clips she perceived as needing the information; the people enrolled on the system were more technically skilled than her. Audience also was a problem for Jillian Decatur during Week 3. She, too, wrote a set of instructions, and sent an invitations to people she knew to try out the instructions; however no one actually followed through to look at them.

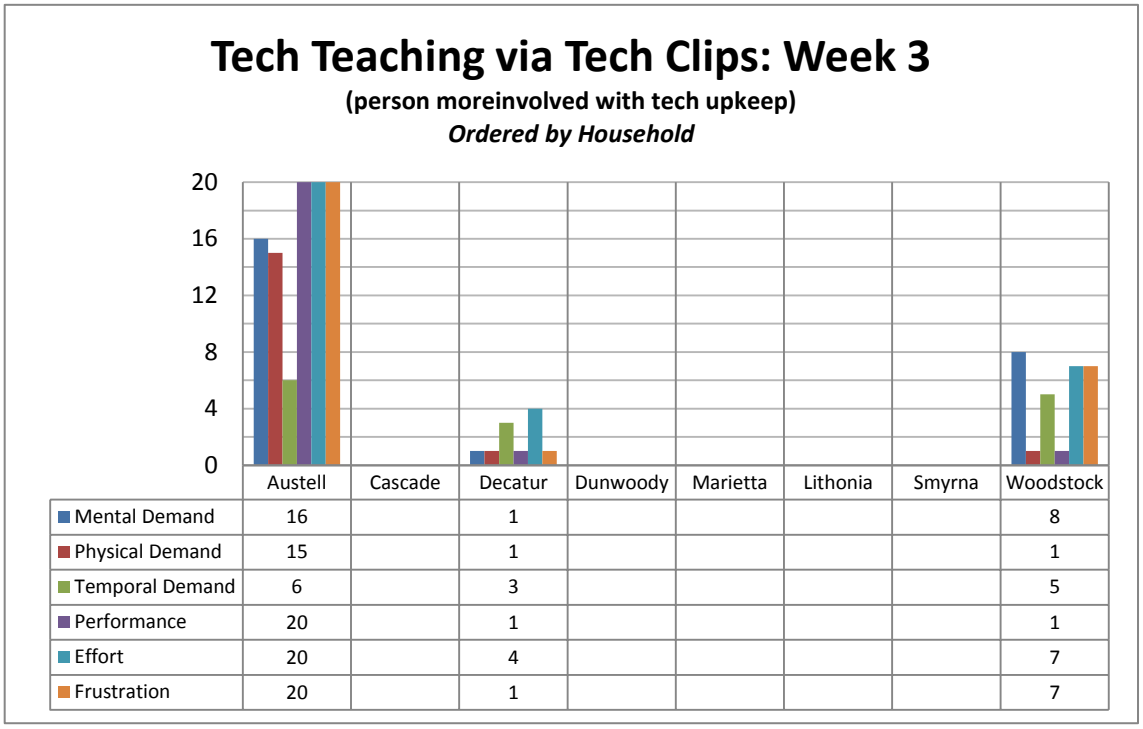
In the Woodstock home, getting a family member to *download* the Tech Clips software was problematic. Matthew asked his father to complete the task, but in order to view the instructions, his dad needed to install Tech Clips. Unfortunately, though, the Tech Clips installation process eluded him; Matthew attempted to coach him over the phone of how to download the software but eventually gave up on the endeavor. Similarly, during week 3 Adrian Austell had the same experience when asking a family member to participate; this family member could not figure out how to install the software, either. During Week 3, Cindy Woodstock tried this task with her mother, who *was* able to download and install the software. Once Tech Clips was installed,

though, problems began. Cindy and her mother were using Tech Clips while simultaneously talking over the phone. Unfortunately the lag time between sending messages and receiving them was frustrating to both parties; I return to a discussion of the impact of this lag later in this chapter.

In total, over the two weeks, nine of the people assigned this task (out of a total of fifteen) did not even attempt it. It is not clear whether participants decided to opt out of this task due to fatigue of being assigned too many tasks in the study, lack of audience on Tech Clips, lack of confidence about their technical ability, shyness or dislike of being on video, Tech Clips' primitive video editing tools that offered no capabilities to edit content, or other reasons. Although "how-to" tutorials specially generated for family and friends may be useful, methods of production and content delivery require more research.

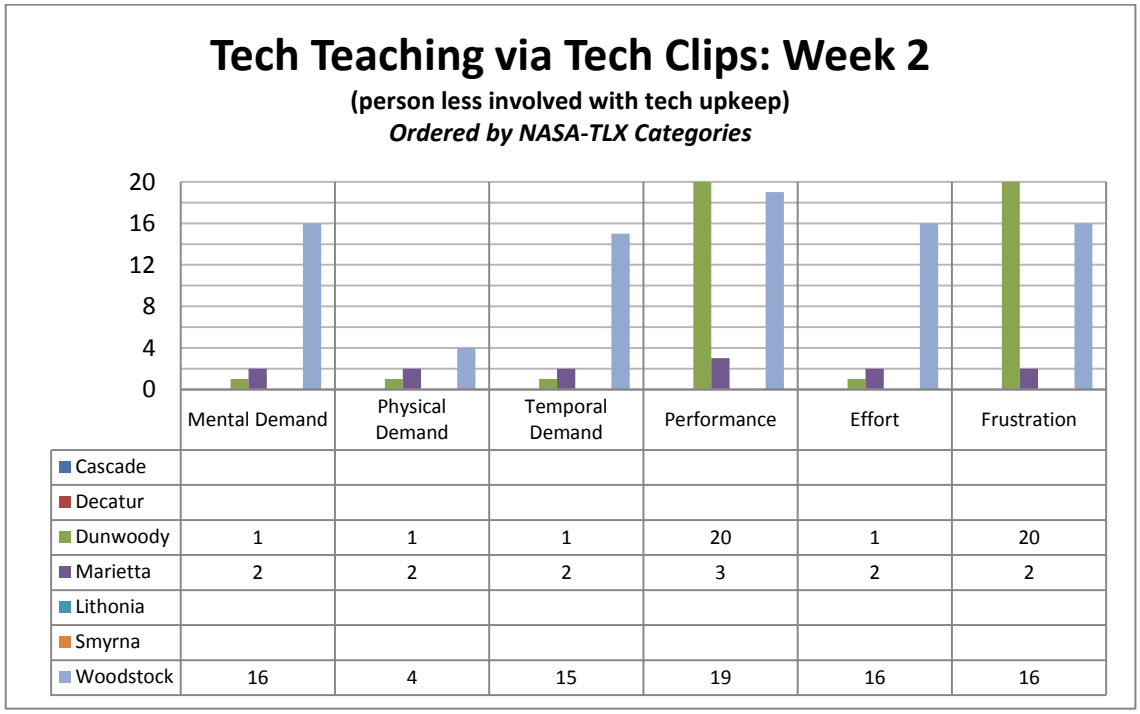


	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock
Mental Demand			1	2			16
Physical Demand			1	2			4
Temporal Demand			1	2			15
Performance			20	3			19
Effort			1	2			16
Frustration			20	2			16

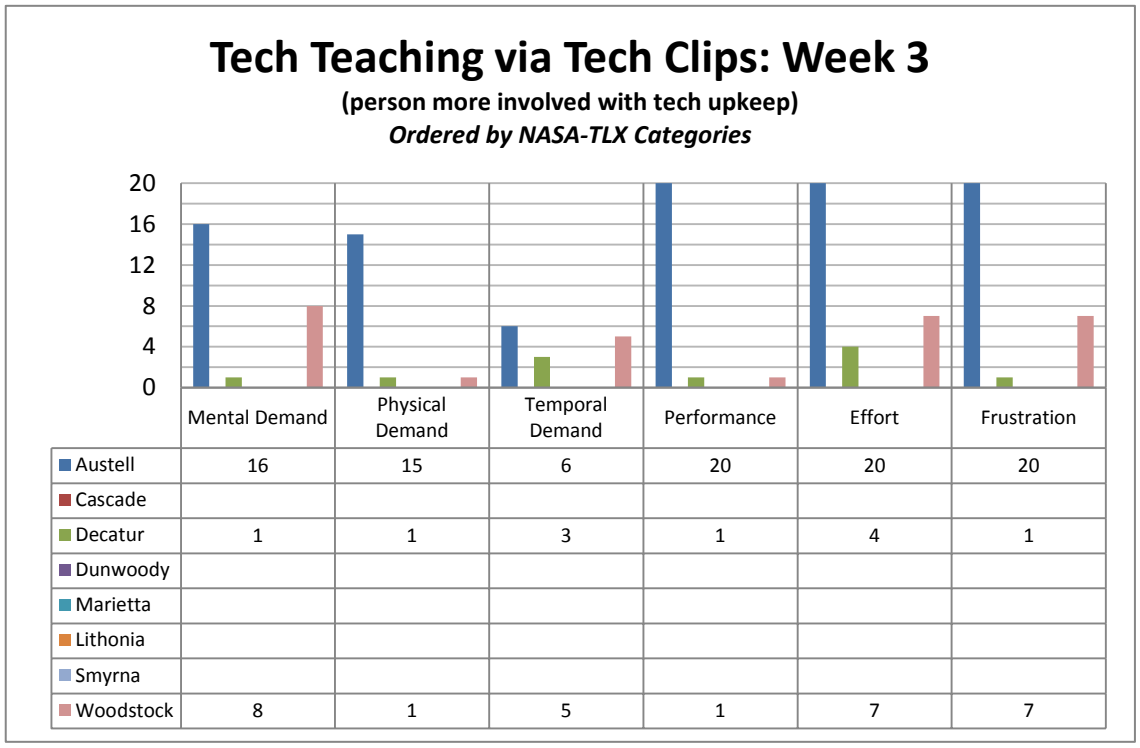


	Austell	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock
Mental Demand	16		1					8
Physical Demand	15		1					1
Temporal Demand	6		3					5
Performance	20		1					1
Effort	20		4					7
Frustration	20		1					7

Figure 6.26: Tech Teaching Via Tech Clips Ordered By Household



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Cascade						
Decatur						
Dunwoody	1	1	1	20	1	20
Marietta	2	2	2	3	2	2
Lithonia						
Smyrna						
Woodstock	16	4	15	19	16	16



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Austell	16	15	6	20	20	20
Cascade						
Decatur	1	1	3	1	4	1
Dunwoody						
Marietta						
Lithonia						
Smyrna						
Woodstock	8	1	5	1	7	7

Figure 6.27: Tech Teaching Via Tech Clips Ordered by NASA-TLX Categories

6.2.8. **Task 2.7/3.7: iPods Online (Configure iPod)**

For Task 7, participants were asked to configure an iPod touch to play music, connect to the home's wireless network, and have an email account configured on the device. The specific prompts householders received are as follows:

> In this week's bag, you'll find an iPod touch. Your mission is as follows… 1.Put a song on the iPod; 2.Configure this iPod to use the wireless Internet in your house. 3.Configure the iPod so that it can send and receive email from an account you use. 4.Send an email from the iPod to info@gthelpstudy.org saying which song you put onto the iPod.
>
> Additional instructions for Week 3: BEFORE YOU BEGIN: If your home successfully completed this task last week, have the person who completed the task last week first reset the device to factory settings in iTunes.

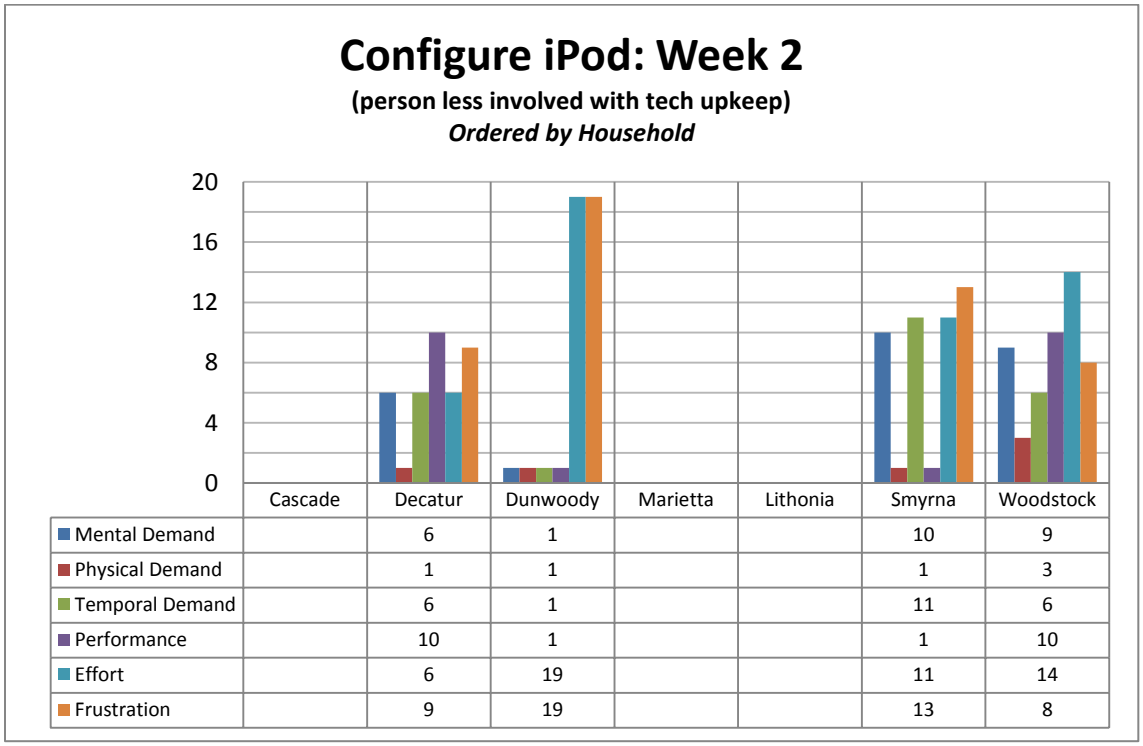
In total, 3 participants were successful at completing the task (both Jessica and Spencer in the Smyrna home as well as Keisha Cascade), 3 did not attempt it (Deedra Lithonia, Adrian Austell, and Steve Dunwoody), and the remaining 9 encountered difficulties. Those who were successful at completing the task already had a person in the home who owned an iPod touch. Of the non-attempters, Adrian Austell already owned an iPod touch, so I did not pack one in her bag. However, I did not realize the one she owned was broken; hence she could not complete the task. Deedra Lithonia, intimidated and easily frustrated by technology, refused to try the task.

Of the nine who had troubles, the problems were by no means homogeneous. The music task presented difficulties for Karina Cascade, who could not figure out how to put only a single song on her iPod. Matthew Hames (Woodstock deployment) tried to email himself an mp3, thinking he could save it onto the music directory on the iPod touch. However, he could only play the song when he opened up the email application on the iPod.

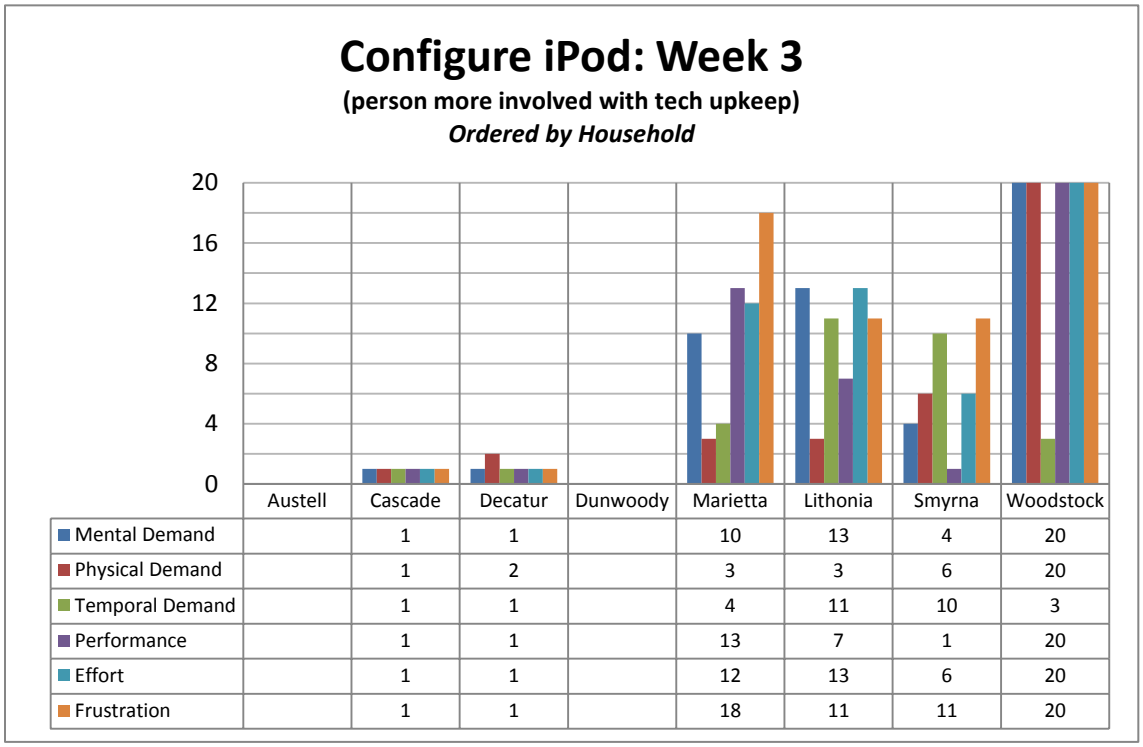
Jamar Lithonia and the Mariettas incorrectly typed the network key into the player, preventing the email portion of the task from being completed; furthermore, the Mariettas' problems with a router-based firewall prevented the iPod from connecting to the network once the correct key was entered. Roy Marietta misunderstood how the iPod touch received music; he thought that music would be sent wirelessly to the iPod touch because it had wireless connectivity but could not figure out where on the interface this non-existent capability was.

Cindy Woodstock, too, encountered difficulties – when she plugged the iPod into her computer, it was recognized as a camera, not as an iPod, so she quit the task at that point. . Mike Decatur's reason for opting out of the music portion of the task was not due to technical difficulties; he explained during the exit interview that he has a mild hearing impairment and does not want to use an in-ear mp3 player to prevent further damage to his hearing.

For Jillian Decatur, ITunes prompted her to update versions in order to use the software, but she had previously lost her libraries when upgrading, and feared she might lose her library again; thus she quit the task at that time. Lastly, please refer to the following chapter for an explanation of Janine and Steve Dunwoody's experience with the iPod touch; there I discuss it in depth.

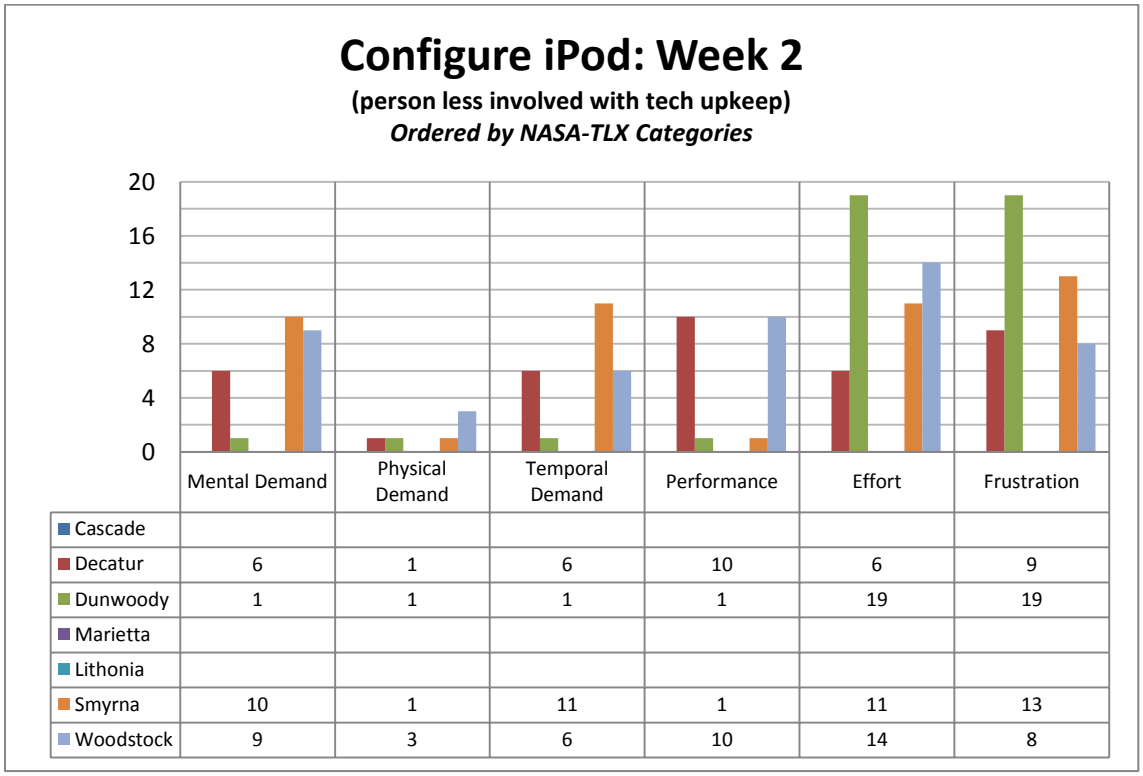


	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock
Mental Demand		6	1			10	9
Physical Demand		1	1			1	3
Temporal Demand		6	1			11	6
Performance		10	1			1	10
Effort		6	19			11	14
Frustration		9	19			13	8

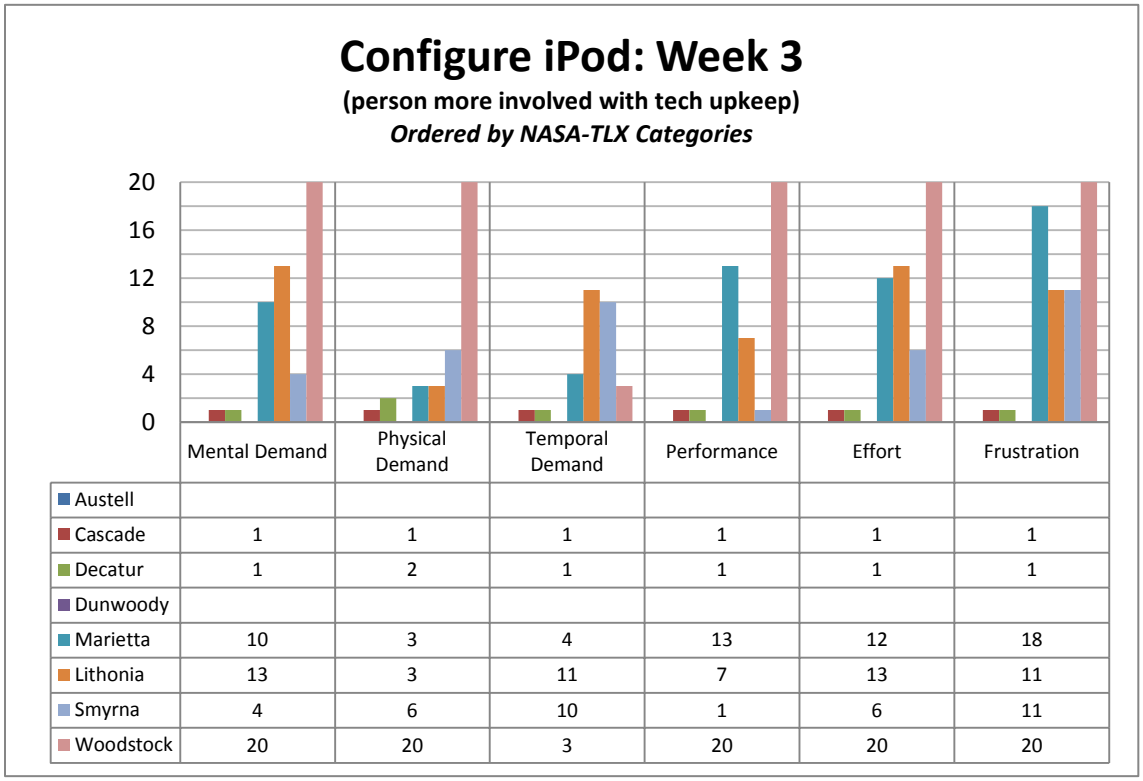


	Austell	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock
Mental Demand		1	1		10	13	4	20
Physical Demand		1	2		3	3	6	20
Temporal Demand		1	1		4	11	10	3
Performance		1	1		13	7	1	20
Effort		1	1		12	13	6	20
Frustration		1	1		18	11	11	20

Figure 6.28: iPod Configuration Ordered By Household



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Cascade						
Decatur	6	1	6	10	6	9
Dunwoody	1	1	1	1	19	19
Marietta						
Lithonia						
Smyrna	10	1	11	1	11	13
Woodstock	9	3	6	10	14	8



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Austell						
Cascade	1	1	1	1	1	1
Decatur	1	2	1	1	1	1
Dunwoody						
Marietta	10	3	4	13	12	18
Lithonia	13	3	11	7	13	11
Smyrna	4	6	10	1	6	11
Woodstock	20	20	3	20	20	20

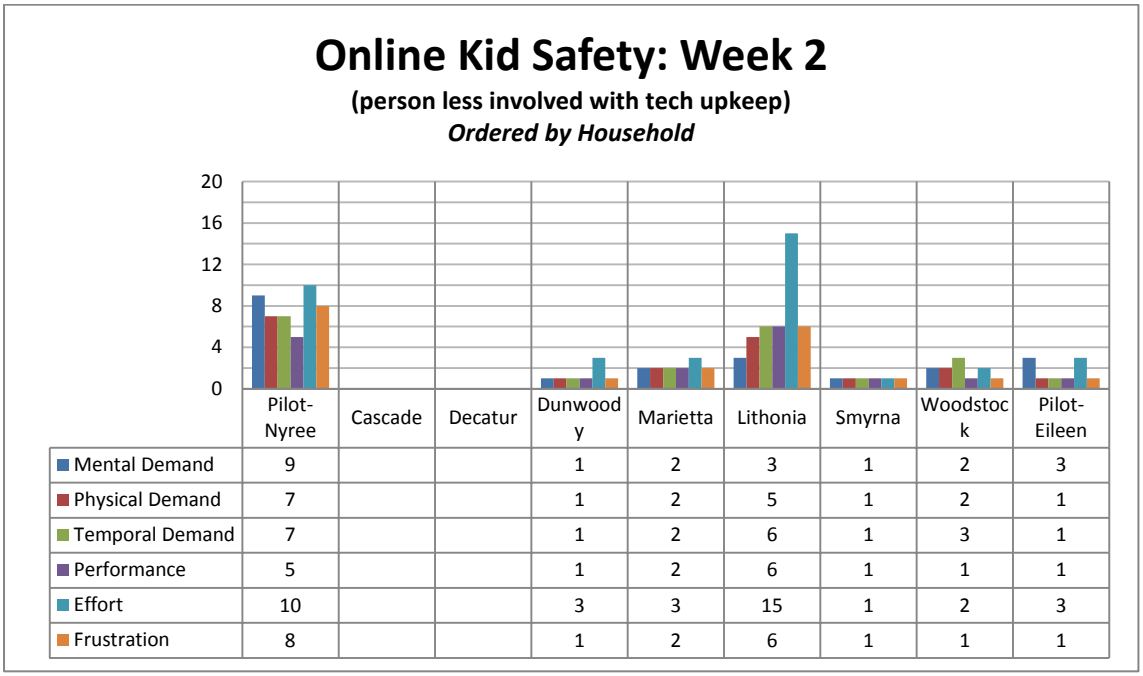
Figure 6.29: iPod Configuration Ordered By NASA-TLX Categories

6.2.9. **Task 2.8/3.8: Youth Online (Explain Strategies for Online Safety)**

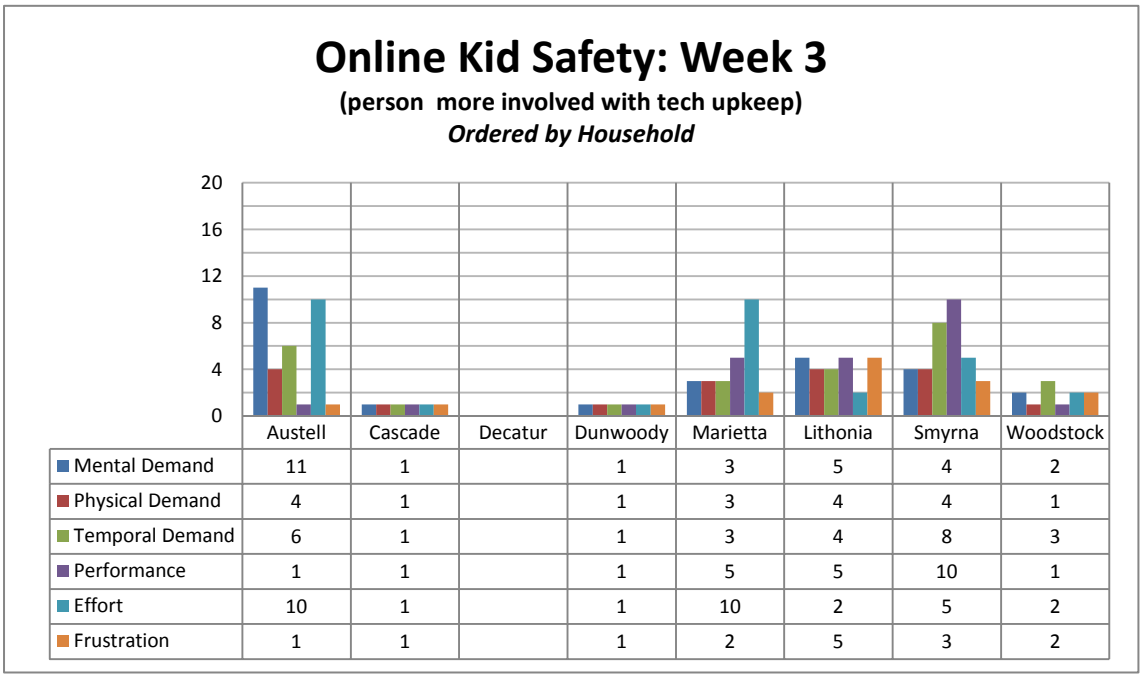
In this task, participants described the top things they could do to keep pre-teens safe online. I had anticipated that because answers were put into Week 2, that people in Week 3 would reuse and build on previously entered content, however they did not do so. The prompt participants received were as follows:

> You're babysitting kids who are 10-13 years old, and they REALLY want to go online. How do you make sure they're only accessing sites that you (and their parents) think are appropriate? Look on the Internet for information about keeping kids safe online. Write a message on Tech Clips explaining the top 3 things you can do in order to keep 10-13 year old kids safe on the Internet.

Participants found information over the web, or reflected on their own personal experience with their children or relatives of a similar age. Specific NASA-TLX responses are in the charts below.

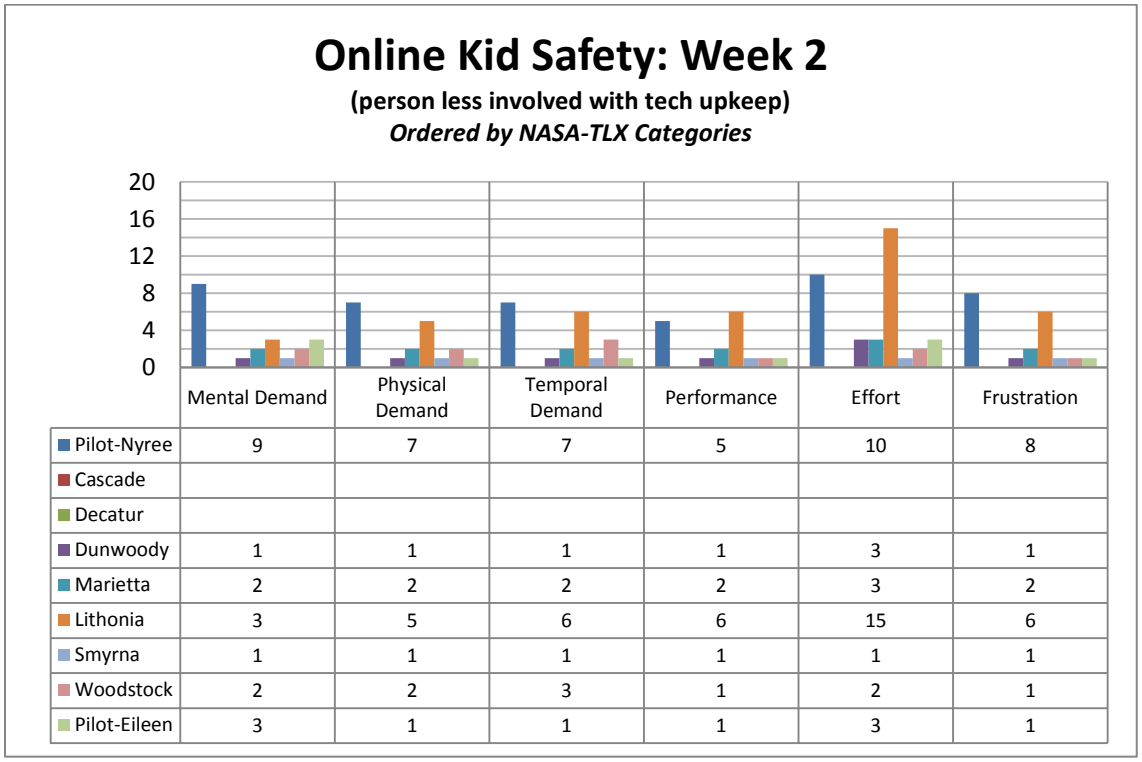


	Pilot-Nyree	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock	Pilot-Eileen
Mental Demand	9			1	2	3	1	2	3
Physical Demand	7			1	2	5	1	2	1
Temporal Demand	7			1	2	6	1	3	1
Performance	5			1	2	6	1	1	1
Effort	10			3	3	15	1	2	3
Frustration	8			1	2	6	1	1	1

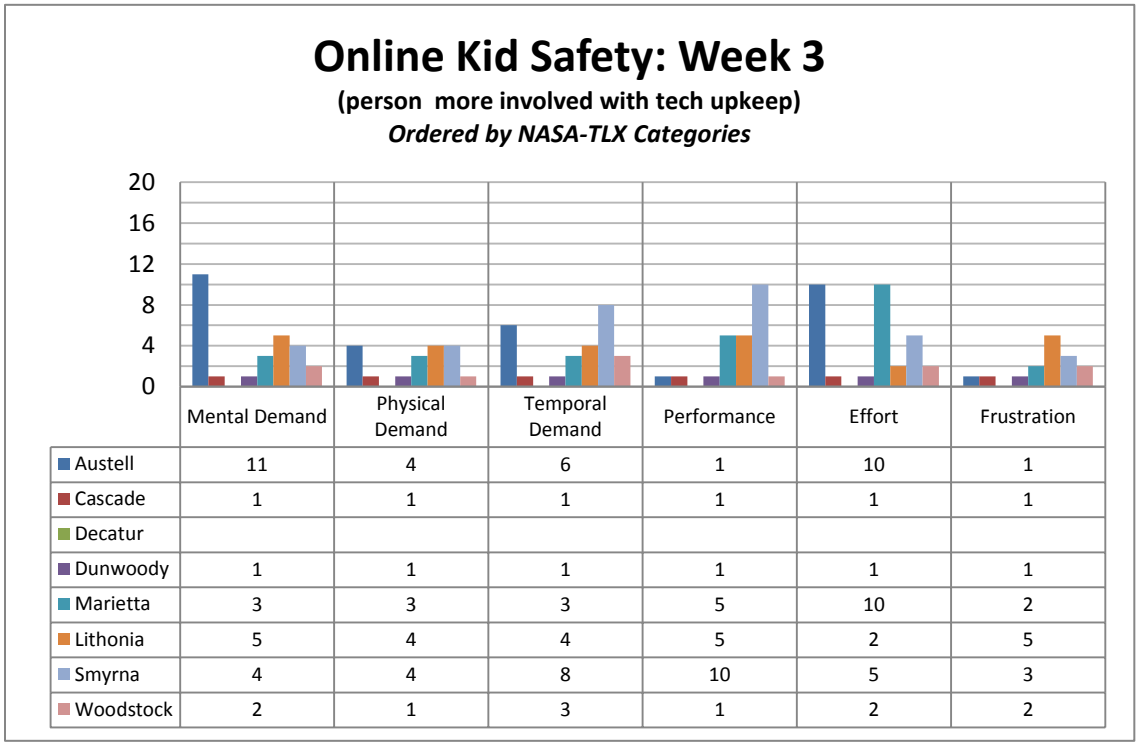


	Austell	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock
Mental Demand	11	1		1	3	5	4	2
Physical Demand	4	1		1	3	4	4	1
Temporal Demand	6	1		1	3	4	8	3
Performance	1	1		1	5	5	10	1
Effort	10	1		1	10	2	5	2
Frustration	1	1		1	2	5	3	2

Figure 6.30: Online Kid Safety Ordered By Household



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Pilot-Nyree	9	7	7	5	10	8
Cascade						
Decatur						
Dunwoody	1	1	1	1	3	1
Marietta	2	2	2	2	3	2
Lithonia	3	5	6	6	15	6
Smyrna	1	1	1	1	1	1
Woodstock	2	2	3	1	2	1
Pilot-Eileen	3	1	1	1	3	1



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Austell	11	4	6	1	10	1
Cascade	1	1	1	1	1	1
Decatur						
Dunwoody	1	1	1	1	1	1
Marietta	3	3	3	5	10	2
Lithonia	5	4	4	5	2	5
Smyrna	4	4	8	10	5	3
Woodstock	2	1	3	1	2	2

Figure 6.31: Online Kid Safety Ordered By NASA-TLX Categories

6.2.10. **Task 2.9/3.9: Configure WiFi Photo Frame**

In this task, participants were asked to configure a digital photo frame with network capability to show pictures from remote sources. I intentionally chose a photo frame that had terrible consumer reviews at online shopping sites (e.g. Amazon.com); reviewers especially noted that this frame frequently had wireless connectivity problems. Thus, I reasoned that by coupling a buggy product with a desirable task (using a digital photo frame that could show Facebook photos, which participants reported as an activity they already engaged in frequently), I could gain information about wireless troubleshooting techniques. Note that I tested each of the frames before putting them into the field; each frame used in the study was indeed functional. Participants received the following prompts for this task:

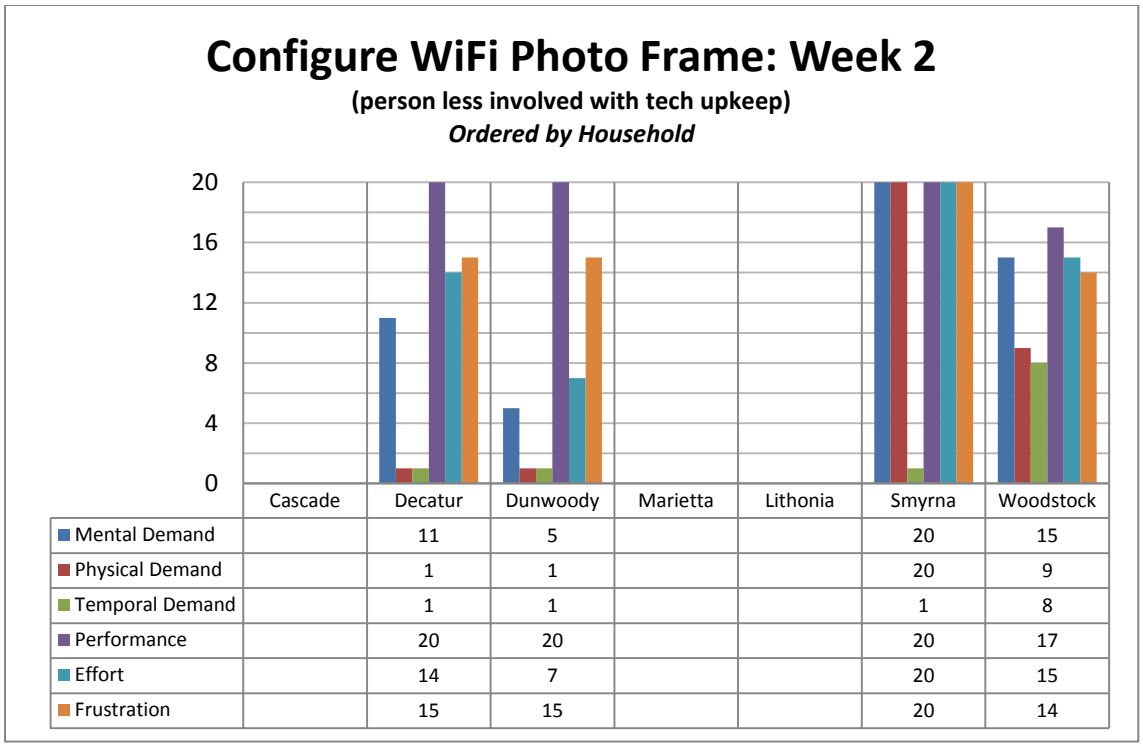
> Week 2 Version: In your box this week, you have a digital photo frame that can connect to your wireless internet AND facebook. Install this photo frame, and configure it so that it shows a friend's facebook pictures on the frame.
>
> Week 3 Version: In your box this week, you have a digital photo frame that can connect to your wireless internet. It also has a feature that lets you send a photo from your cell phone to the frame's display. Figure out how to get a picture taken on your cell phone to show up on the display.

The following participants did not attempt the task at all: Cascade Week 2 (Karina, Viola, and Kassandra), Deedra and Jamar Lithonia, and Steve Dunwoody. The Cascade home admitted that they started the tasks too late and ran out of time. Jamar Lithonia and Steve Dunwoody both noted that they did not want to get "too attached" to a device they could not justify buying at this point in time.

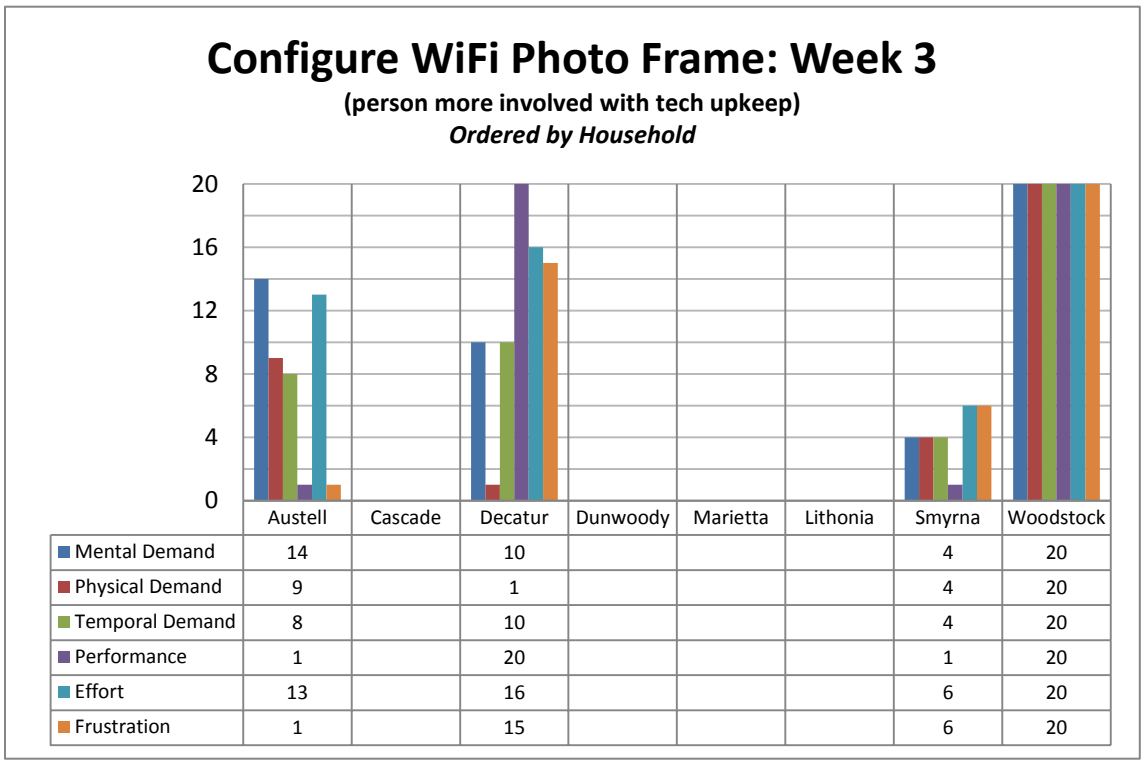
Only one person (Adrian Austell) was able to configure the frame properly; she reported that her approach to completing this task was just to read the manual. The remaining homes attempted to configure the frame, but the experience did not go well. In the Smyrna home, Jessica

and Spencer both tried to get the frame connected to their network, but were both unsuccessful. Whenever they tried to pick their network out of the list of available ones, the frame would not let them select it. Eventually, they found they could get photos onto the frame using a USB cable, but wireless connectivity did not work. The Decaturs and Woodstocks had a similar experience, but did not find a workaround to the problem, even after reading the manual carefully and searching online for info.. Keisha Cascade attempted to configure the device by connecting it via USB cable to her computer; when she connected the frame via cable to the computer, it froze remained unresponsive (had she read the directions that came with the device, she would have seen that the device needs to be configured *without* being plugged into to a computer as a bootstrap).

Wireless network keys again proved to be a problem that stymied installation. Janine Dunwoody reported that she " was excited to give it a try because I love looking at my friend's photos on facebook, but the instructions were beyond me." When the frame prompted her to enter a WPA key, she did not know what this was, and gave up on the installation. In the Marietta home, neither Roy nor Karen could not enter their wireless network key onto the device; due to a manufacturing error in the frame, the soft keypad was missing a capital 'Q' in its keypad, having the letter 'J' twice instead; more info about this occurrence is discussed in Chapter 8.

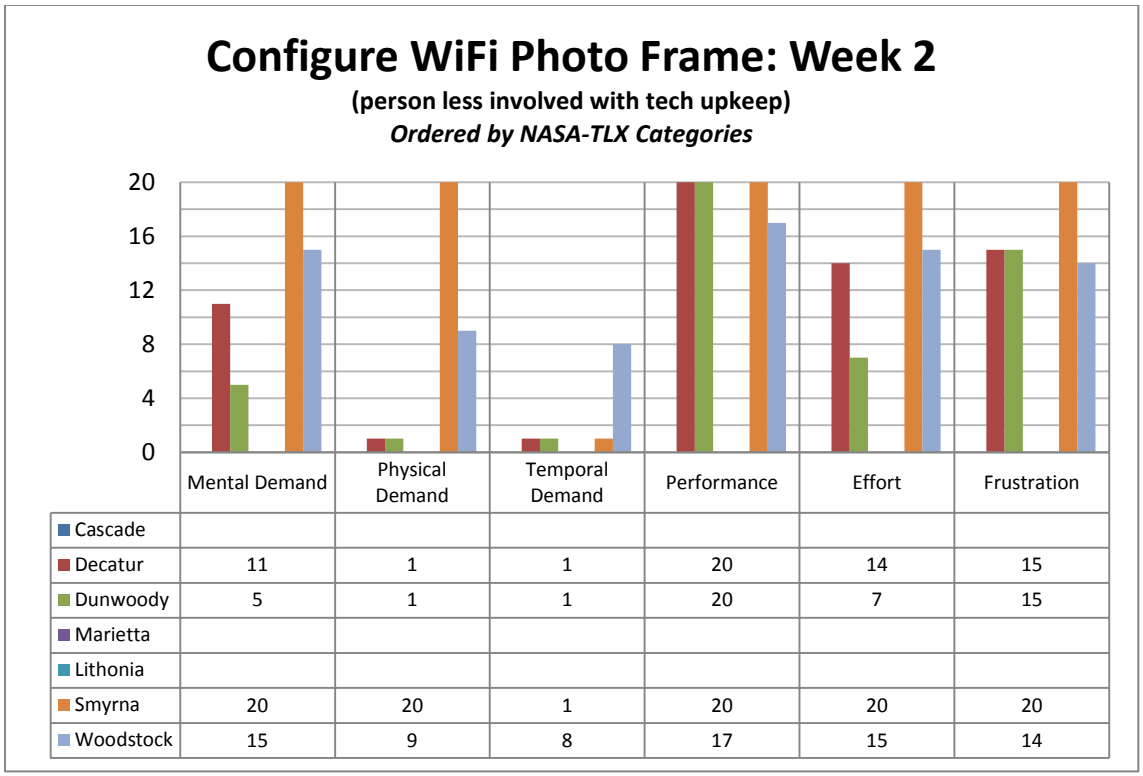


	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock
Mental Demand		11	5			20	15
Physical Demand		1	1			20	9
Temporal Demand		1	1			1	8
Performance		20	20			20	17
Effort		14	7			20	15
Frustration		15	15			20	14

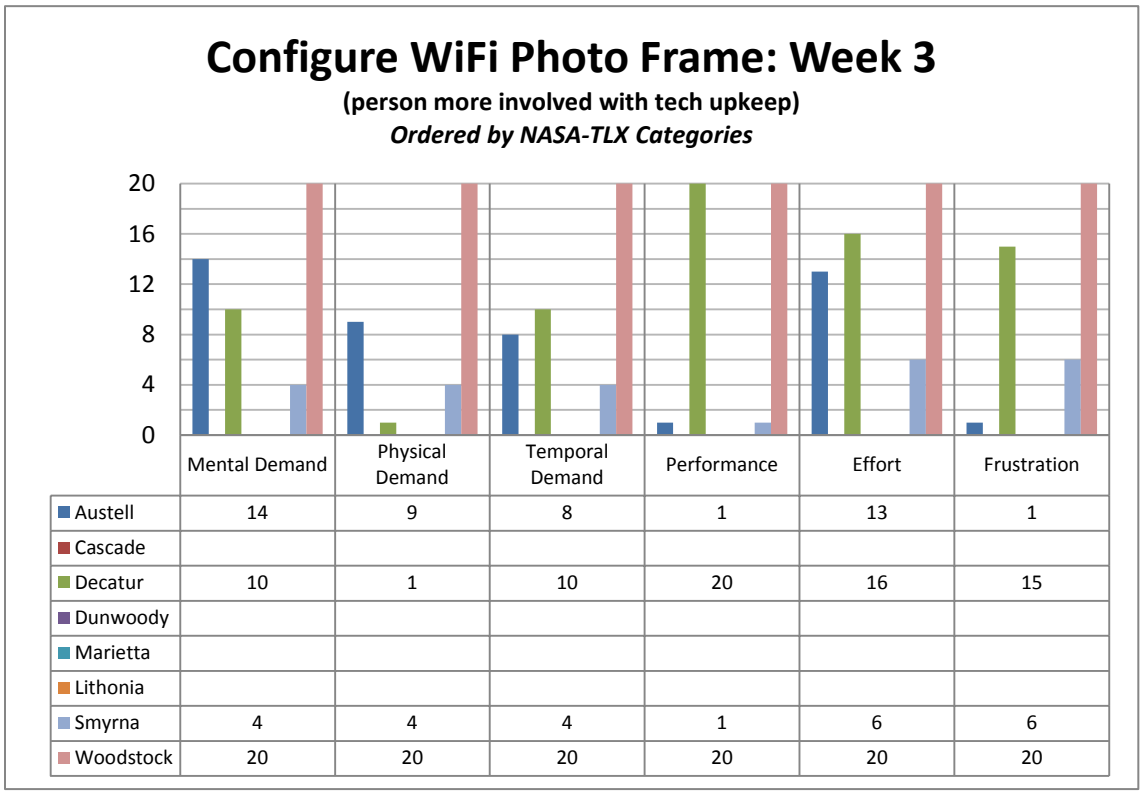


	Austell	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock
Mental Demand	14		10				4	20
Physical Demand	9		1				4	20
Temporal Demand	8		10				4	20
Performance	1		20				1	20
Effort	13		16				6	20
Frustration	1		15				6	20

Figure 6.32: WiFi Photo Frame Configuration Ordered By Household



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Cascade						
Decatur	11	1	1	20	14	15
Dunwoody	5	1	1	20	7	15
Marietta						
Lithonia						
Smyrna	20	20	1	20	20	20
Woodstock	15	9	8	17	15	14



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Austell	14	9	8	1	13	1
Cascade						
Decatur	10	1	10	20	16	15
Dunwoody						
Marietta						
Lithonia						
Smyrna	4	4	4	1	6	6
Woodstock	20	20	20	20	20	20

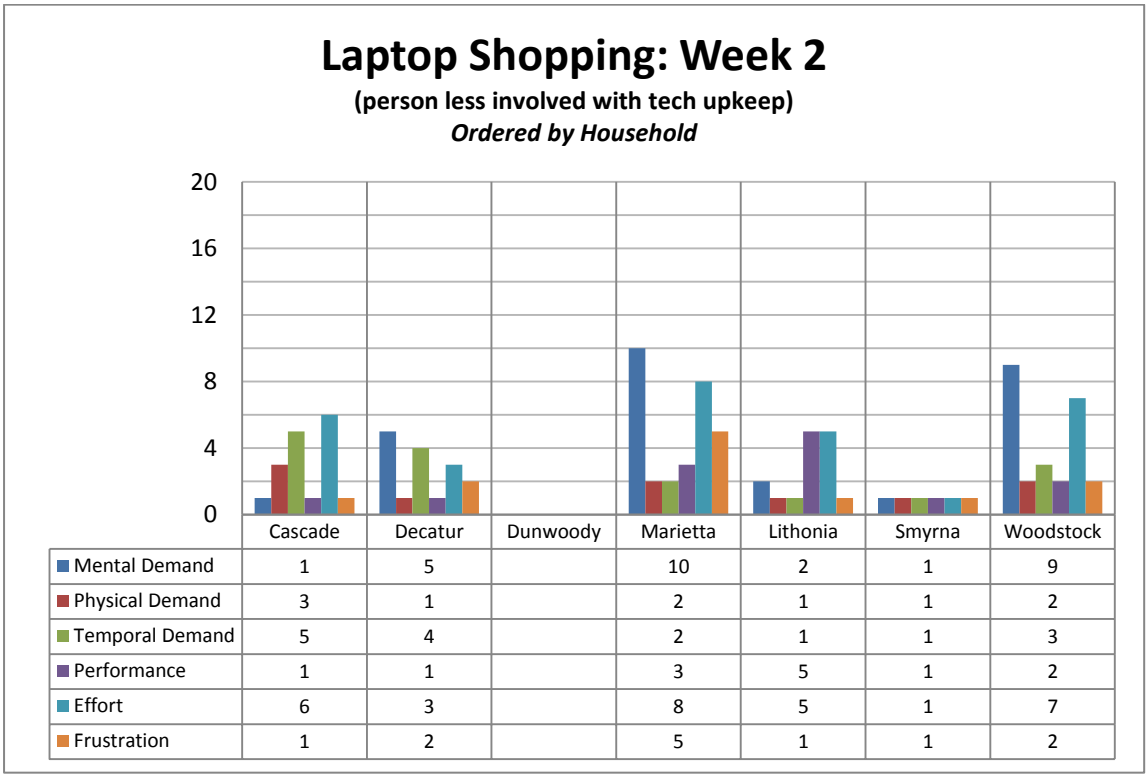
Figure 6.33: WiFi Photo Frame Configuration Ordered by NASA-TLX Categories

6.2.11. **Task 2.10/3.10: A New Computer (Shop for a New Laptop)**

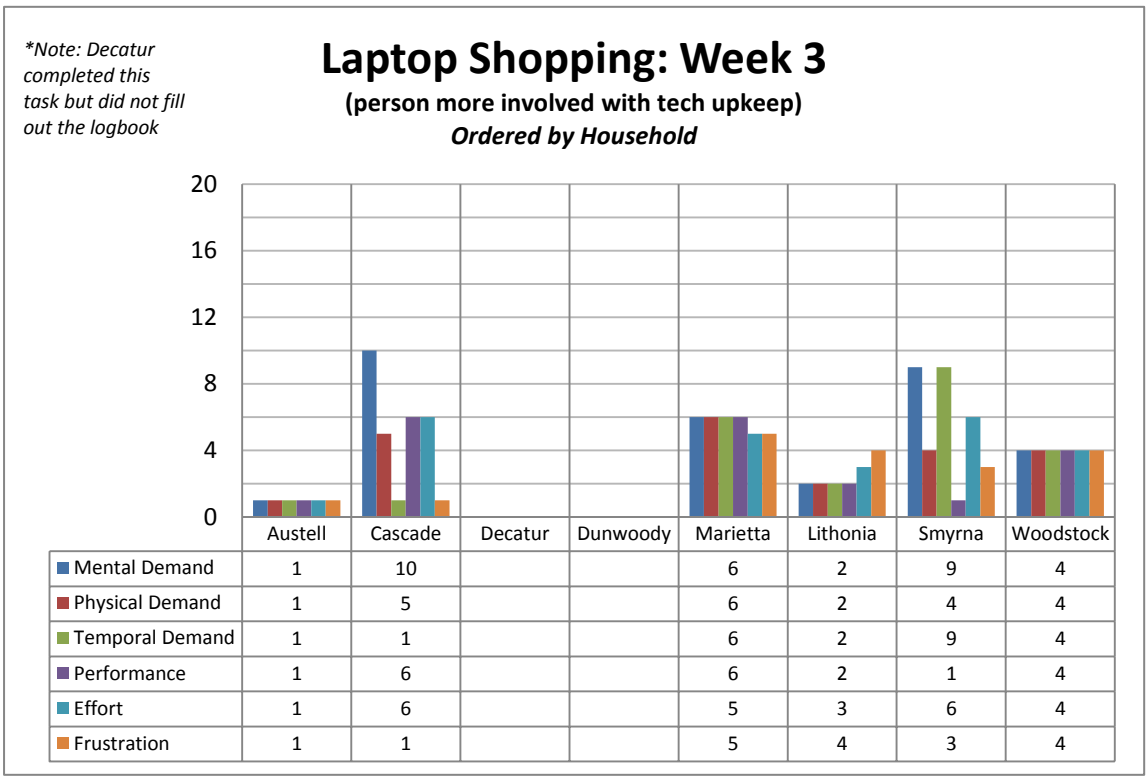
In this task, participants were instructed to imagine they were shopping for a new laptop, and provide information about what they would choose and why. I included this task to learn more about each home's technology purchasing habits. The specific prompt for Weeks 2 and 3 is as follows:

> Oh no! Imagine your toddler grabbed your laptop computer and threw it in a puddle of mud in the backyard. Now your computer is ruined! You need to buy a new one, pronto! But what will you choose? Research laptops in any way you prefer and send an email to info@gthelpstudy.orglisting the following: •Which laptop you'd buy; Why you chose this laptop; Where you'd buy the laptop; How much the laptop costs; Why you chose this particular store

Across the participants, this task was viewed as successful and low in frustration. Complete NASA-TLX scores are listed in the charts below. Participants predominantly looked at the websites of three major retailers: Dell, Apple, and Best Buy. Deedra Lithonia made her purchasing decision based on what Jamar had bought for the house in the past. Jillian Decatur specifically chose a PC over a Mac due to the requirements for her work. Keisha Cascade chose a Dell because she liked the design on the cover of a particular model. Adrian Austell, Jessica Smyrna, Cindy Woodstock, and Roy Marietta chose Apple laptops due to the perception that they are safe from viruses and malware. Matthew Hames (Woodstock home) and Jamar Lithonia chose laptops primarily based on price. Spencer Concord (Smyrna) chose a laptop based on features. Karen Marietta chose a laptop based on the results of a "What laptop should you buy?" quiz she found at about.com. The Dunwoodys did not complete this task, for reasons described in the following chapter. Note, however, that no one chose items based on perceived compatibility with items already existing in the home.

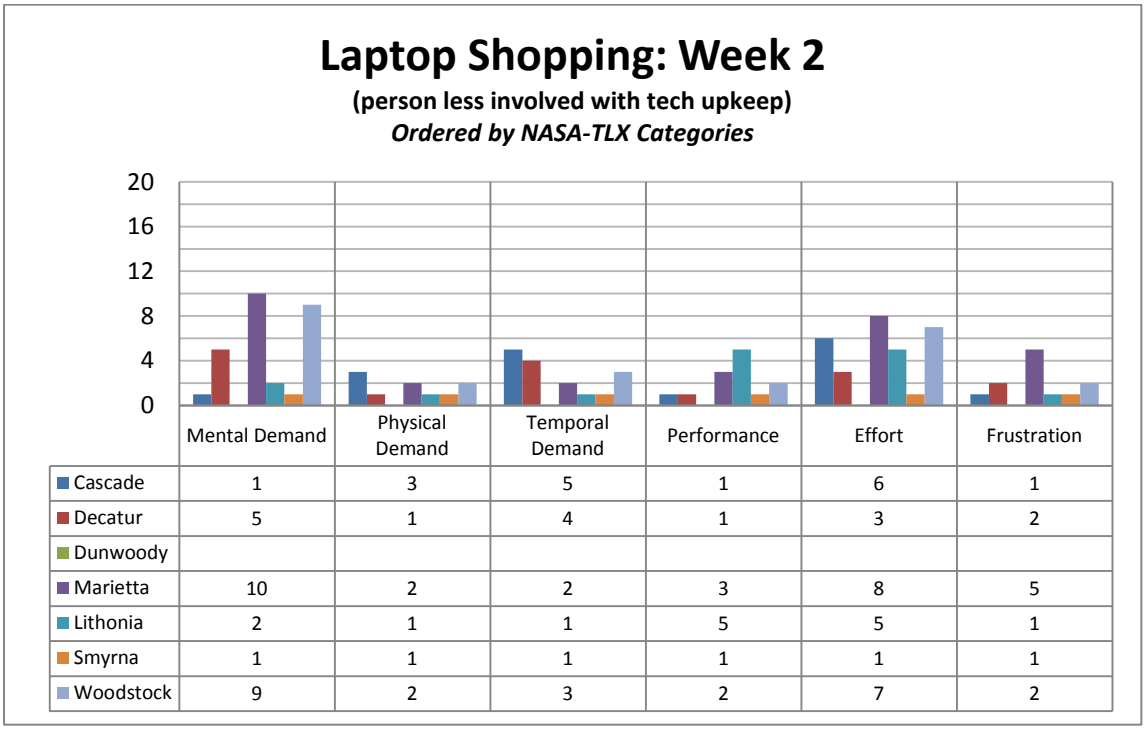


	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock
Mental Demand	1	5		10	2	1	9
Physical Demand	3	1		2	1	1	2
Temporal Demand	5	4		2	1	1	3
Performance	1	1		3	5	1	2
Effort	6	3		8	5	1	7
Frustration	1	2		5	1	1	2

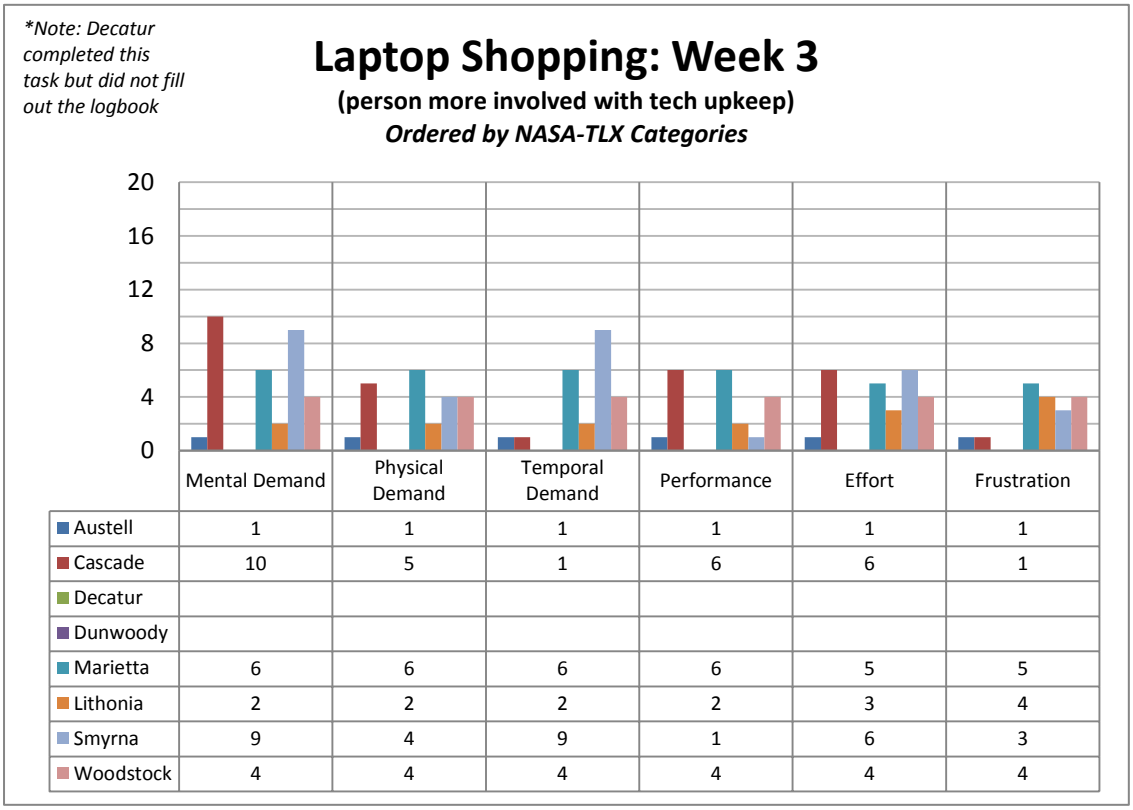


	Austell	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock
Mental Demand	1	10			6	2	9	4
Physical Demand	1	5			6	2	4	4
Temporal Demand	1	1			6	2	9	4
Performance	1	6			6	2	1	4
Effort	1	6			5	3	6	4
Frustration	1	1			5	4	3	4

Figure 6.34: Laptop Shopping Ordered By Household



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Cascade	1	3	5	1	6	1
Decatur	5	1	4	1	3	2
Dunwoody						
Marietta	10	2	2	3	8	5
Lithonia	2	1	1	5	5	1
Smyrna	1	1	1	1	1	1
Woodstock	9	2	3	2	7	2



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Austell	1	1	1	1	1	1
Cascade	10	5	1	6	6	1
Decatur						
Dunwoody						
Marietta	6	6	6	6	5	5
Lithonia	2	2	2	2	3	4
Smyrna	9	4	9	1	6	3
Woodstock	4	4	4	4	4	4

Figure 6.35: Laptop Shopping Ordered By NASA-TLX Categories

6.2.12. **Task 2.11/3.11: Webcam Tutorial**

The final task of the week was to complete a webcam tutorial that would explain how to complete one of the tasks already completed in the study. The prompt for this task was as follows:

> Using Tech Clips, make a video that provides instructions that could help someone else who is trying to do one of the tasks you did this week. (Pick any task you like). Share this video with someone who doesn't live in your house, and see if they can follow the instructions you gave.

Seven did not attempt the task, six completed it, and two experienced difficulties. While this task was not difficult, per se, the opt-out rate of it is rather high; I believe this may be due to participant fatigue – it was the 11th task in a single week. In retrospect, I may have added additional weeks to the study while reducing the number of tasks per week. Those who did not complete the task included Keisha Cascade, Roy Marietta, Deedra Lithonia, Mike Decatur, Jessica Smyrna, and Janine Dunwoody. Jamar Lithonia and Jillian Decatur attempted to make tutorials on Tech Clips, but camera problems detracted from these efforts; their voices either could not be heard or faded out midway through the video.

Karen Marietta made a standalone video about online safety for kids and teens; she emailed the video a friend with a daughter who was of the appropriate age. Cindy Woodstock made a video explaining how to edit Wikipedia, providing specific examples from her own experience completing the task. Steve Dunwoody made a video on Tech Clips explaining how to edit a Wikipedia page; he made this video for his brother-in-law, who was the only person who join the installation. It appears from watching the video that Steve may have thought this task was not representative of something he would have done if not asked during the study; he describes the experience as "gay" at the end of the video.

Matthew Hames (Woodstock deployment) provided instructions of how to shop for laptops online. Adrian Austell chose the same task for her video, however, she just read the description of the task verbatim and named a friend who she would like to have try the task (her friend, by the way, did not complete the task).

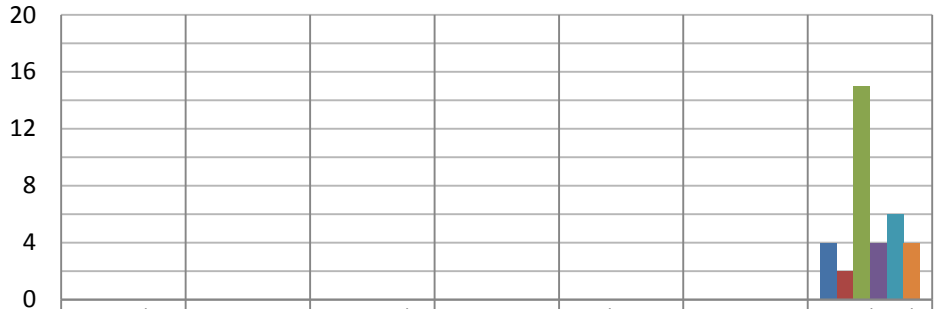
Viola and Kassandra Cascade took creative liberty with their choice of tutorial; both were avid cooks, and instead of talking about technology at home, they set up their computer in the kitchen and made a short video on Tech Clips explaining how to make pasta sauce

Marietta, Cascade created tutorials but did not record them in log book

Create Video Tutorial: Week 2

(person less involved with tech upkeep)

Ordered by Household



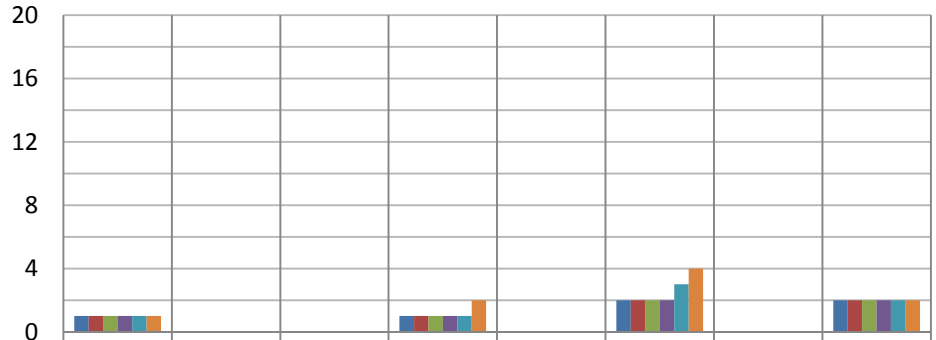
	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock
Mental Demand							4
Physical Demand							2
Temporal Demand							15
Performance							4
Effort							6
Frustration							4

Decatur created a tutorial but did not record in log book

Create Video Tutorial: Week 3

(person more involved with tech upkeep)

Ordered by Household



	Austell	Cascade	Decatur	Dunwoody	Marietta	Lithonia	Smyrna	Woodstock
Mental Demand	1			1		2		2
Physical Demand	1			1		2		2
Temporal Demand	1			1		2		2
Performance	1			1		2		2
Effort	1			1		3		2
Frustration	1			2		4		2

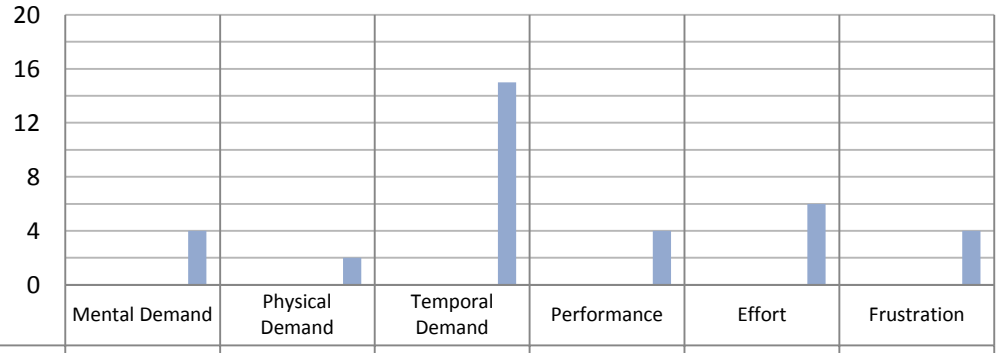
Figure 6.36: Video Tutorial Creation Ordered By Household

Marietta, Cascade created tutorials but did not record them in log book

Create Video Tutorial: Week 2

(person less involved with tech upkeep)

Ordered by NASA-TLX Categories



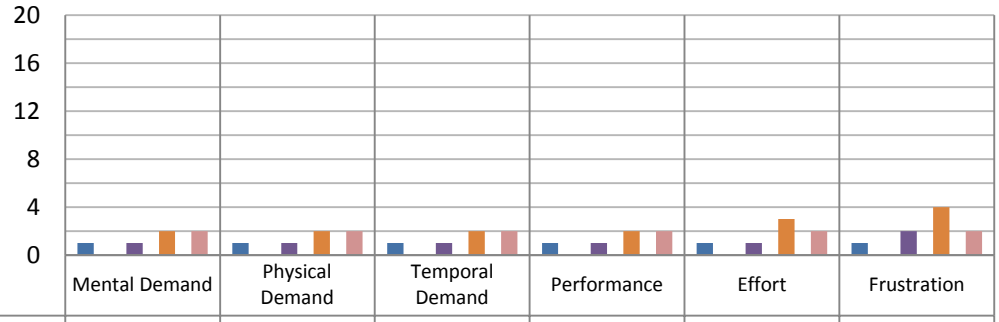
	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Cascade						
Decatur						
Dunwoody						
Marietta						
Lithonia						
Smyrna						
Woodstock	4	2	15	4	6	4

Decatur created a tutorial but did not record in log book

Create Video Tutorial: Week 3

(person more involved with tech upkeep)

Ordered by NASA-TLX Categories



	Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration
Austell	1	1	1	1	1	1
Cascade						
Decatur						
Dunwoody	1	1	1	1	1	2
Marietta						
Lithonia	2	2	2	2	3	4
Smyrna						
Woodstock	2	2	2	2	2	2

Figure 6.37: Video Tutorial Creation Ordered By NASA-TLX Categories

6.3. **Tech Clips Usage**

How was Tech Clips appropriated throughout the study? Unfortunately, the system did not see as much adoption as I had hoped. Table 6.1 shows the people who were in each system, the number of videos created, URLs shared, and text messages written. I also include a count of the number of automated messages generated by the system (e.g. messages welcoming a new years), as well as system failures experienced when recording content (e.g. when a user attempted to make a video but for some reason the video infrastructure did not work properly). The numbers show that over the three weeks, most of the Tech Clips installations had little content other than what was required based on the tasks participants created. Why did Tech Clips not do so well? I believe the problems were due to several factors.

First, the recruitment process left the burden on the hands of the households, rather than the researchers. The people who were recruited had no incentive to participate, other than for a $15 gift card; I discuss these recruitment issues in more depth later in the chapter.

Second, the people who did join had no pressing *real* need to use the system, nor did it offer anything interesting in return for the effort of participation (excluding, of course, Adrian's baby videos, which were presumably interesting to her family). This points to the fact that technical problems are intermittent needs, having a persistent system for providing help may not be a recommendable paradigm.

Third, there were usability issues with Tech Clips that may have deterred adoption. By default, Tech Clips stayed in the dock/system tray persistently, only providing notifications as needed. I thought this design decision would be unobtrusive, yet useful. However, what I found is that the software was forgotten by users, or they did not think to look in the system tray or dock to maximize the main interface (even though they had been shown how to do exactly that during the entry interview)

Fourth, the video recording interface in Tech Clips was both primitive and buggy. Participants experienced problems with video recording trouble (e.g. sound not recording). The software also did not support any advanced editing features, or even deletion of mistaken content; thus participants may have been reluctant to use the system knowing that any mistakes would be permanently etched into the system.

Table 6.2: Tech Clips Usage Data

		video	url	text	sysfail	auto	Total
Austell	Adrian	10	3	18	0	1	**32**
	COUSIN_ADRIAN	0	0	1	0	1	**2**
	COUSIN_ADRIAN_2	4	0	5	0	1	**10**
	DAD_ADRIAN	0	0	0	0	1	**1**
	FRIEND_ADRIAN	0	0	0	0	1	**1**
	Austell Total	**14**	**3**	**24**	**0**	**5**	**46**
Cascade	Karina	0	0	0	0	1	**1**
	Keisha	4	3	3	0	1	**11**
	Viola	4	1	7	0	1	**13**
	Cascade Total	**8**	**4**	**10**	**0**	**3**	**25**
Decatur	Jillian	5	6	25	11	2	**49**
	Mike	0	1	4	0	1	**6**
	SISTER_JILLIAN	0	0	0	0	1	**1**
	Decatur Total	**5**	**7**	**29**	**11**	**4**	**56**
Dunwoody	BROTHER_JANINE	0	0	0	0	1	**1**
	Janine	0	2	2	0	1	**5**
	Steve	5	2	3	0	1	**11**
	Dunwoody Total	**5**	**4**	**5**	**0**	**3**	**17**
Lithonia	Deedra	2	2	1	0	1	**6**
	Jamar	15	2	4	0	2	**23**
	Lithonia Total	**17**	**4**	**5**	**0**	**3**	**29**
Marietta	Roy	2	5	5	0	1	**13**
	Marietta Total	**2**	**5**	**5**	**0**	**1**	**13**
Pilot	Eileen	6	0	9	0	1	**16**
	Nyree	0	1	24	4	2	**31**
	SON_EILEEN	0	0	1	1	1	**3**
	Pilot Total	**6**	**1**	**34**	**5**	**4**	**50**
Smyrna	Jessica	1	2	1	0	1	**5**
	Spencer	2	7	6	0	1	**16**
	MOM_SPENCER	0	0	0	0	1	**1**
	Smyrna Total	**3**	**9**	**7**	**0**	**3**	**22**
Woodstock	COWORKER_CINDY	0	0	0	0	1	**1**
	COWORKER_CINDY_2	0	0	0	0	1	**1**
	MOM_CINDY	0	0	0	0	2	**2**
	STEPDAD_CINDY	0	0	0	0	1	**1**
	Matt	3	5	9	0	1	**16**
	Woodstock Total	**3**	**5**	**9**	**0**	**6**	**23**
Total		**63**	**42**	**128**	**16**	**32**	**281**

6.3.1. **Recruitment**

Recruitment of family and friends who would serve as Tech Clips users proved a significant hurdle for all of the homes. Across all nine installations of Tech Clips (1 pilot installation plus 8 post-pilot installations), only 10 people joined. Of those ten, only two completed the post-survey inquiring about their reasons for usage (or lack thereof). Thus, to understand why people did or did not use the software, I rely on accounts relayed by primarily households, log data, and triangulation based on other tasks householders performed in throughout the study. Householders reported that convincing family and friends that this tool was worth the time and effort to install was challenging. As Cindy Woodstock stated:

> I asked as many people as possible. It was kind of difficult because a lot people didn't want to install something to their computer.

Why did people not want to install a program? Was it that it was too much effort for too little gain? (Yes, that is likely). Was it that the software might take up precious space on an already full hard drive? (Yes, that is also likely). However, could something *else* have been preventing usage? Based on the ways householders approached other tasks in the *Family Facilitation Study,* I hypothesize that the reasons for not installing the software might be more subtle than "it was too much effort."

6.3.2. **Installation: The Security Paradox**

Inexperienced computer users, at times, are cast as oblivious and uncaring about information security issues. On closer inspection, however, it seems that decision-making processes of novice users may not be simply borne of an uncaring attitude. In fact, the Tech Clips study participants *all* could recount painful episodes of virus and spyware infections, and in response to these past events, they took on a vigilant (though at times ill-informed) attitude toward security.

Participants who were less skilled with computers consistently showed a pattern in which they were overly cautious about the security implications of unfamiliar computing tasks. For instance, in the pilot study, Nyree recorded the following entry in her logbook when attempting to install a Network Attached Storage (NAS) device:

> I put in the CD to load program. It asked various questions on whether I would allow to make changes (I was very cautious). Then it asked if I wanted it to go through firewall so I tapped on that and it said to put it on an allowed list so that the "hole" can close and won't let worms through. But when I closed that window it said it was installed???? But I didn't have a USB to USB cord so I gave up and uninstalled it which also made me a little nervous. This task made me afraid that I was harming my computer. It needed to be more friendly for people like me who are afraid to press anything.

This same fearfulness also showed up in tasks that to a computing researcher would seem harmless, such as editing a Wikipedia page. When editing an entry on Wikipedia, the website shows users a stark warning message informing that IP addresses of anonymous contributors will be recorded. Even though participants did not always know what an IP address was or why it was important, this message stopped them in their tracks; three entirely refused to edit the page due to security concerns, or after receiving advice from more knowledgeable people in their social networks telling them not to complete the task.

When it comes to installing a piece of software like Tech Clips, which is (1) not affiliated with any major computing brand (e.g. Yahoo, Google, Microsoft); (2) hosted at a web domain that is not particularly meaningful (www.gthelpstudy.org); and (3) has a very unfamiliar installation process, it might be expected that potential users would raise a suspicious eyebrow toward the software.

The installation process for Tech Clips, in retrospect, I believe was particularly problematic. Tech Clips was written using Adobe AIR, and to install AIR applications, users must

click a large button on a website (called an "installer badge"). When the button is clicked, a secondary program from Adobe launches in a pop-up window. This secondary program checks if appropriate packages are installed to support AIR applications. However, the look and feel of this secondary program also looks somewhat like a pop-up ad or spyware-infested application. It looks nothing like the installers typically used by Microsoft Windows programs, thus I am not surprised that the installation process of Tech Clips may have raised the suspicions of potential users.

Unfortunately, I do not have logs available to compare software download attempts versus users who joined the system. The server that hosted the Tech Clips download page uses a rotating log system; hence by the time I realized this problem might have been occurring, the web server logs had already been deleted. If I were to do this again, I would have archived web server logs, as well as instrumented the software itself to send a notification to the research team when an installation attempt was terminated early.

That being said, people enrolled in the study had few reservations about downloading software packages off the Internet for photo collages or making webcam videos. This begs a very important question – not just for tools that can be used to facilitate help – but also for software available for download on the web more broadly. What cues do users employ to decide whether something on the web is dangerous or not? Why do some computer activities seem frightening, yet others elicit a carefree response? Are there specific cues in the download sites that people use? Are people less cautious when the download is part of a task perceived as relevant, meaningful, and fun? Are there other factors at play? When I asked householders to articulate how they decided whether a website was safe or not, many said that they "just know," that this decision making happened intuitively. An interesting area for future research would be to learn more about this intuition that is used as part of determining whether tasks are safe or dangerous.

6.3.3. **Usage: The Importance of (Perceived) Audience**

When it came to Tech Clips, the most common question asked by users was *not* about getting help with technology. Instead, the most common question was *"Is anyone here?"* Householders were not sure whether anyone was actually paying attention to the content they posted, nor did they always understand that content with in the system was always broadcasted. As Jillian Decatur wrote in her logbook:

> Tech Clips made it difficult to do anything but record/send the video - and even then, you didn't know whether it was (a) sent, (b) received and (c) even recorded. Also - we did not find it clear who we were sending it to and who else would see it - not clear how to send it to only a specific person.

The implication of this is that providing feedback on who is viewing content may be important in encouraging use. However, having what seemed like the *wrong* audience could also be a disincentive. Janine Dunwoody did not know that other people in her social network perceived Wikipedia editing as a challenging task, and thought that her audience was inappropriate for what she was posting:

> I know how to complete this task on Wikipedia and I know how to have a conversation with someone on TechClips, but I was unable to invite anyone who didn't know much about computers onto TechClips. I sent an invitation to 5 people and online one joined. He already knows a lot more about this than me.

Hving not just an audience, but having the *right* audience for one's messages may be a critical point that makes or breaks a piece of software similar to Tech Clips. Two of the deployments had the these elements in place; in these deployments, the person on the other end was well matched both in ability and interests. Users received feedback on their posts, and the posts were more conversational in nature. A particularly salient (and inspiring) interaction is in Table 6.2, collected

during the Pilot study. In this thread, Nyree provided words of encouragement to Eileen, who was disappointed that she could not complete one of the tasks in the study. The interactions between Nyree and Eileen suggest that a potential way to increase a technology novice's sense of self-efficacy and confidence may be to pair novices together, so that they may not only learn from one another, but also provide support.

Table 6.3: Nyree Cheers on Eileen in Tech Clips

Conversation Title	Content in Conversation
Week 3, Task 4: 21ST Century Home Videos	Eileen (2010-04-18 12:50:17): 44s video: [There's no sound in the video.] Eileen's seated in her spare bedroom at the computer, and is dressed in her US Postal Service work uniform. The Tech Clips logbook is on the bed. She waves at the camera, says something indistinguishable, and picks up the logbook, showing it to the camera. At the end of the video, she waves, appearing to say the word "bye." Nyree (2010-04-18 13:02:35): AWESOME EILEEN !!!!!!!!!!!
Task 5: iPods are for what?	Eileen (2010-04-18 12:50:17): Because of my inablity to complete Task 3, I was unable to do this task. Nyree (2010-04-18 13:05:31): Eileen we did do most I wasn't able to connect the hard drive thing to the network ???? So I did try and that's important. I'm proud of you. You did the video. Hey why didn't you dance in it???

6.3.4. **Reuse Support for Content Archiving, Browsing, and Searching**

I had built the Tech Clips interface such that it archived every piece of information within the system, to promote the construction of a long-lasting knowledge base about a home's computing environment. However, I did not see people reusing and building upon one another's content. This may have been due to a lack of scaffolding, user interface problems, or some combination of both. In particular, users posted content into the wrong conversations, and were unable to move them to the correct place. As Jillian Decatur recorded *into* Tech Clips, presumably as a note to the research team:

> I didn't know to start a new conversation in order to talk about a new subject. Therefore, my answers before beginning the Photo Collage task seem to have been placed in the Wikipedia project note/conversation.

With respect to video recording, the mechanisms in the system were (in the spirit of a technology probe) intentionally simple. They did not allow for re-recording, deleting, or annotation of content. Any mistakes made while recording were permanently etched into the system for all to see. In retrospect, however, I believe that not allowing for re-recording and making changes to the content may have deterred people from using the system. From these experiences, I would recommend that future tools for home support include simple, quick, usable ways to rearrange content and undo mistakes (which is, of course, a user interface recommendation that is easy to give, but difficult to implement).

6.4. **Family Facilitation Study: The Vision vs. The Experience**

In the following sections, I explain challenges inherent in software tools for help provision, as well as lessons learned that can influence the design of future tools that increase one's effectiveness and confidence while reducing perceptions of the time and effort cost associated with the provision of

technical help. Recall, through this study I was attempting explore RQ3 and its sub-questions. To recap, these questions are:

- ***RQ3: How does the presence of a tool with features grounded in the empirical research of RQ1 and RQ2 change the dynamics of domestic help provision? In particular:***
    - ***3.1: To what extent can software tools for giving and receiving help within one's social network help people become effective at completing home computing application tasks, and home networking setup and maintenance tasks?***
    - ***3.2: To what extent can software tools for giving and receiving help within one's social network help people become more confident about using and maintaining residential computing infrastructures?***
    - ***3.3: To what extent can software tools for giving and receiving help within one's social network decrease subjective perceptions of time and effort cost of providing technical help?***

To explore these questions, I had carefully designed a series of tasks that I believed would encourage people to adopt and use Tech Clips, a piece of software for sharing and archiving technical advice with a trusted group of friends and family. Research, however, can veer away from initial plans; what I thought was most important to study turned out to be a side note in the story of understanding how to support technical assistance in residential settings Since I initially proposed these research questions, I have come away with a much different perspective on software for facilitating advice sharing. To explain this shift, let me first begin by explaining what I found with respect to these research questions.

Tech Clips was adopted in unexpected ways, and at times not used at all. While I initially set out to better understand the roles that software for giving and receiving technical assistance can help with self-efficacy, increasing confidence, and reduction of burden, It is difficult to attribute whether the software itself did any of those things.

6.4.1. **Burden and Effectiveness**

In the situations in which Tech Clips was used to provide technical assistance, it is not clear that Tech Clips per se reduced the burden of providing technical help to one's family and friends. In particular, the process of *installation* of the Tech Clips software proved to be too burdensome for some; study participants reported experiences in which they had to coach their family members and friends over the phone in setting up the software (similarly to what was seen in the *Help at Home* study in Chapter 4). To reduce this burden, however, it seems that any software for providing remote assistance should either be parceled into the operating system or be included as a standard package that is installed when a computer is first acquired.

Beyond installation barriers, some design choices made within Tech Clips led to the experience of help provision being perhaps *more* burdensome. I had not anticipated that the software would be used as a secondary communication channel (e.g. while simultaneously being over the phone, family members would use Tech Clips with one another). In these situations, Tech Clips did not show data instantaneously to the other side; due to some caching mechanisms to allow offline use of the software, it would take 1-2 minutes for content to go from sender to recipient. Thus, having to wait such a long time between sending and receiving content proved to be frustrating and burdensome. This is not to say that *all* software for technical advice sharing is necessarily burdensome, but it does suggest that the approach I took may not have been ideal. I discuss alternatives that might be more appropriate in Chapter 8.

With respect to effectiveness, I had (perhaps implicitly) thought Tech Clips users would reuse content, building and learning from what was already in the system. However, they used the system primarily in an input-only fashion; I did not see instances in which users built off of one another's knowledge, even when they were completing the same task. This may have been because they did not have scaffolding that would help them build off one another's knowledge, or it might

have been because the layout of the interface did not support searching and browsing content in ways that were intuitive to users.

6.4.2. **Self-Efficacy and Confidence Shifts**

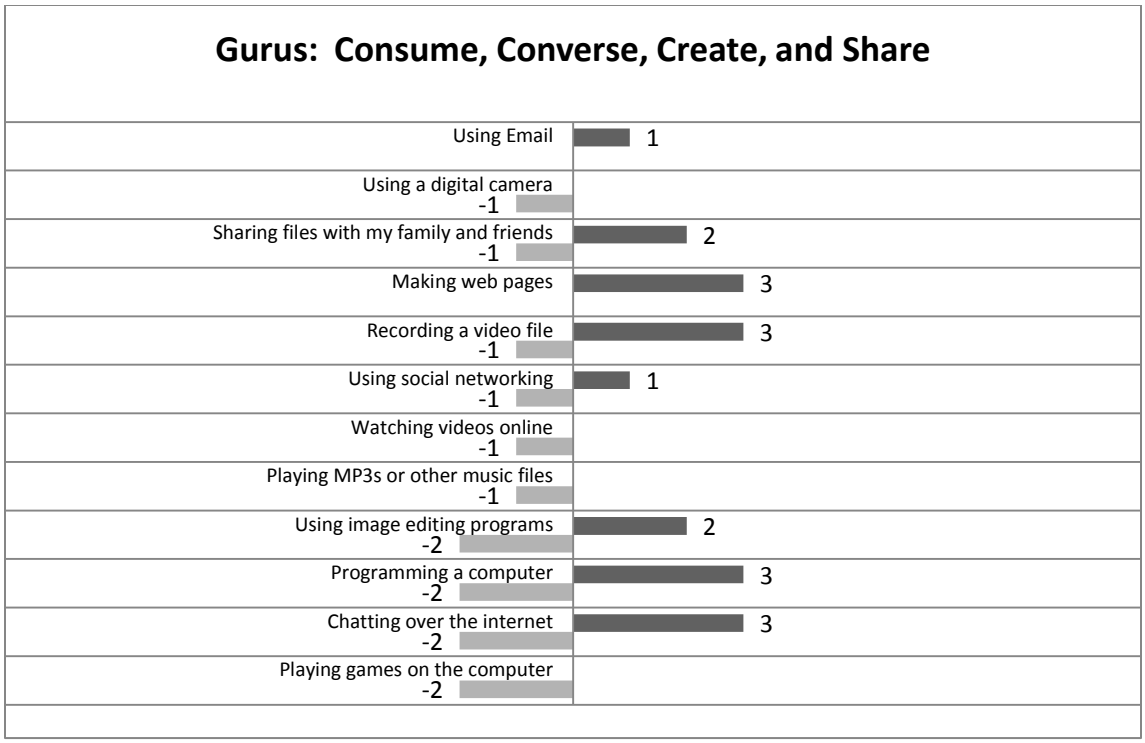
When it comes to self-efficacy and confidence, however, the *study itself* may have shifted confidence. I provide two figures below: Figure 6.40 and Figure 6.41. More extensive figures with data from each participant are in Appendix C. In these figures, I show the number of participants who experienced confidence changes. To read the scale, a value such as "Using Email" = 1 would indicate that one person had an increase in their confidence about this activity. Conversely, a value such as "Programming a Computer" = -2 would indicate that two people experienced confidence decreases for this task.

For participants who were not confident in their computing abilities (e.g. predominantly those who completed Week 2 tasks), they typically experienced confidence gains with tasks related to everyday usage of technologies, such as using a smart phone, emailing, recording media files, and playing games. However, we also see drops in confidence when it came to knowing computer-related terms and being able to know if websites were trustworthy or not; it is plausible that through the study they became more aware of gaps in their knowledge

The confidence results for those who are the household "computing gurus" shows a less drastic set of changes ; for everyday computing tasks (e.g. using Email) their confidence levels did not shift up or down sharply. Where I did see a *decrease* in confidence was in the statement inquiring about "Teaching my family and friends about technology." For this statement, half of the gurus reported a drop in confidence.

Yet what caused these changes? Was it the order of the tasks? The software? Something else? It is hard to separate confounding variables. Follow-up work with a revised software

prototype and a more rigorous study design (e.g. an A-B-A design) may provide more conclusive information about the role of technical assistance software in increasing confidence and reducing perceived burden of help-giving.



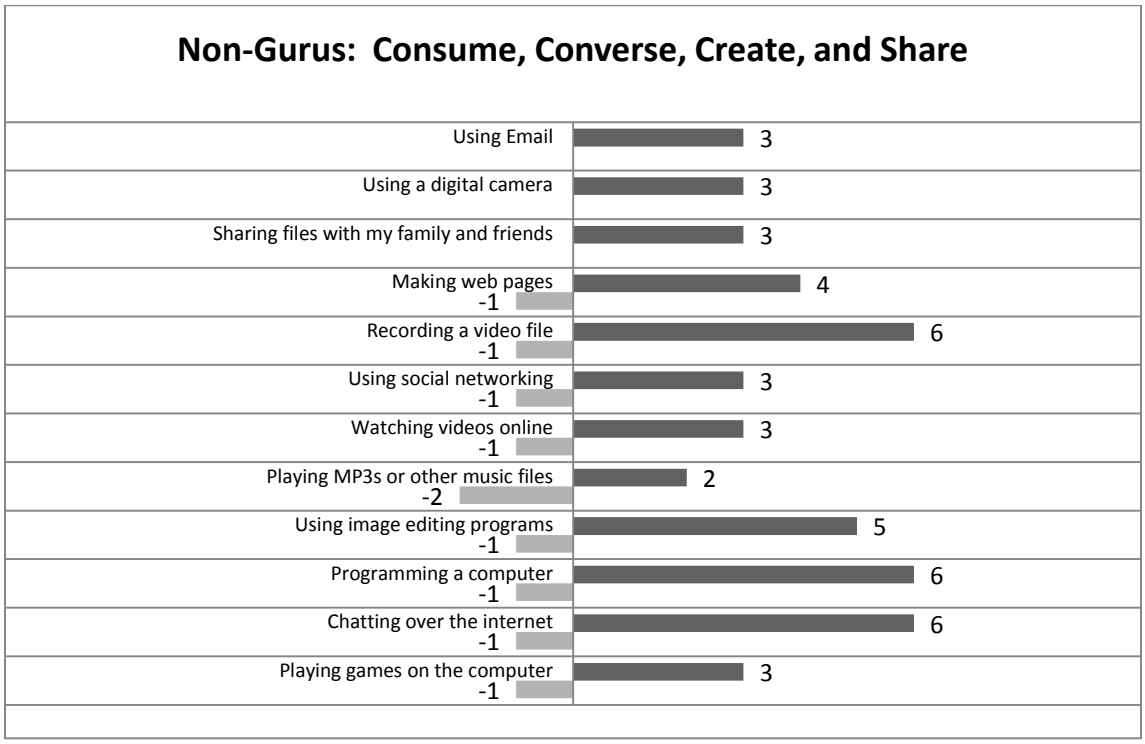
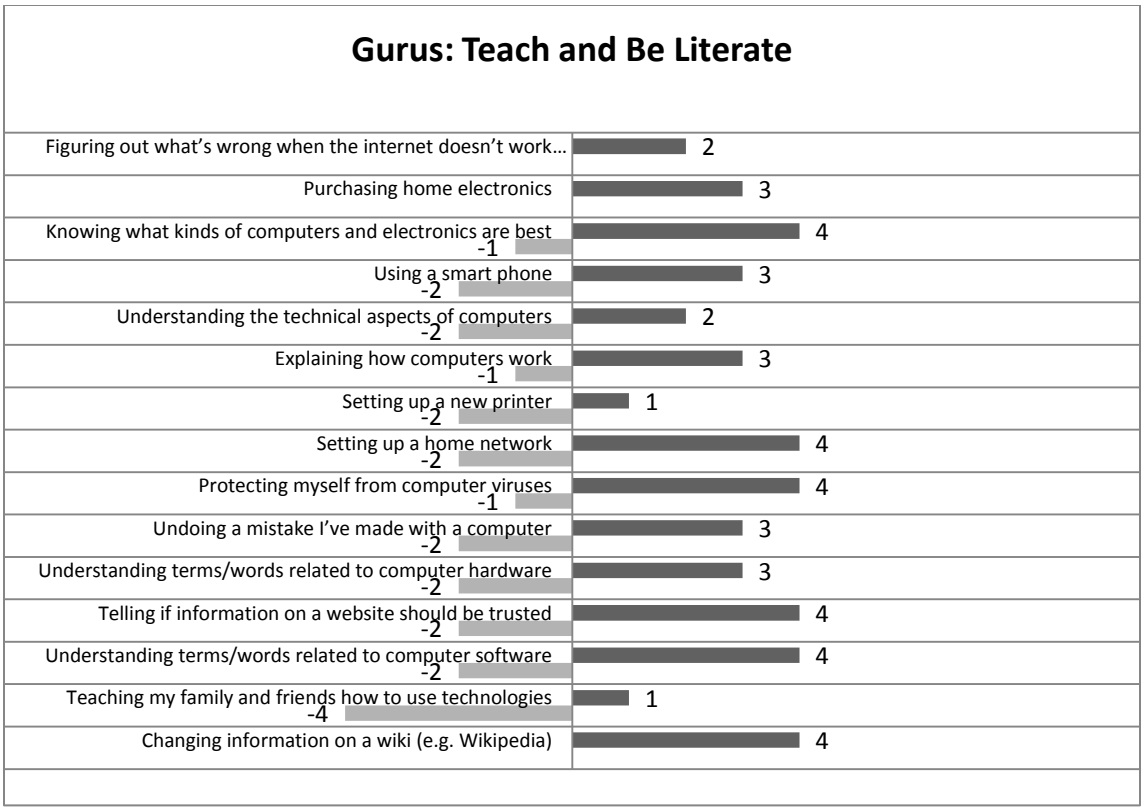


Figure 6.38: Confidence Shifts for Consuming, Conversing, Creating, and Sharing



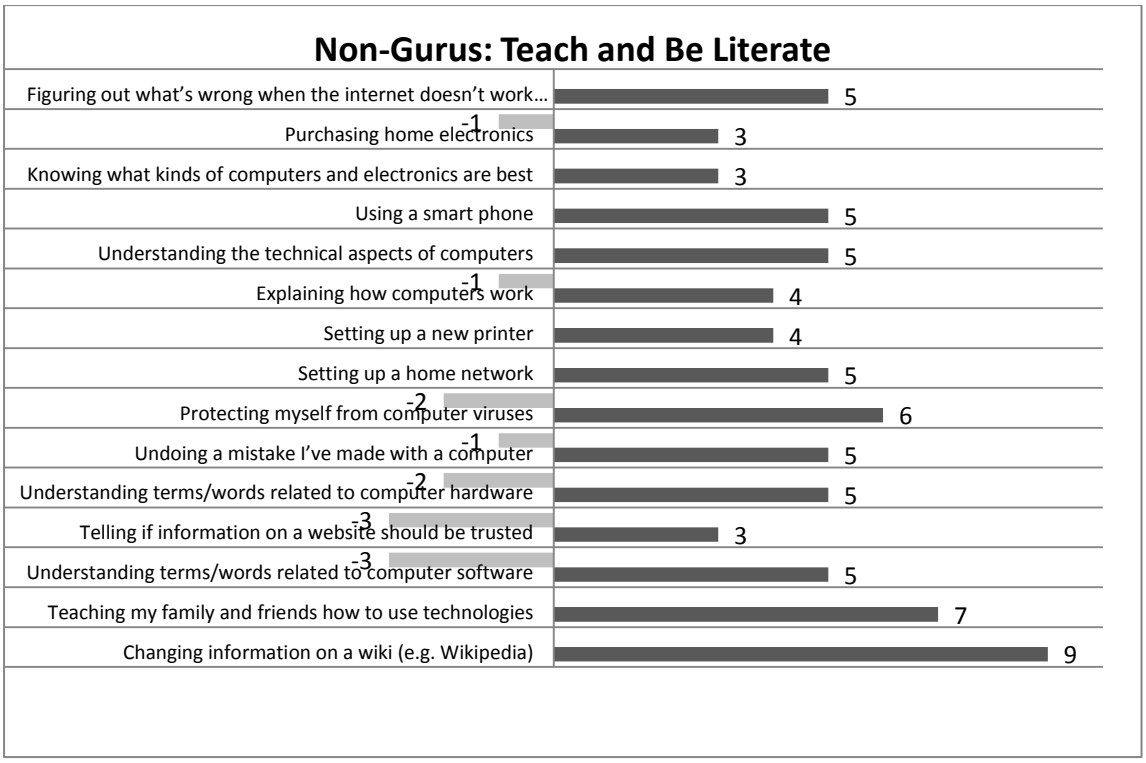


Figure 6.39: Confidence Shifts for Teaching and Being Technologically Literate

6.5. **Emergent Uses**

In three of the homes (Austell, Lithonia, Woodstock), householders appropriated Tech Clips in a way I did not expect; rather than using it as a standalone tool, they used it as a secondary communication channel. That is, they used Tech Clips while simultaneously speaking over the phone to a remote user, usually a parent who was new to the software.

Given the fact that I had built Tech Clips with the intention that it could be used as a robust knowledge base – one that would be accessible even if the Internet was down – I made some design decisions that did not support this emergent use. I had envisioned that the software should have been usable as a reference even if the Internet were inaccessible. In order to support this offline caching of content (and not crash the server supporting the software either), content was synchronized with a remote server once a minute. This means that if a user posted a message, it could be 1-2 minutes before the message was received on the other side. This not-quite-instantaneous nature of the software was frustrating for users; they would post messages to people on the other end of the phone, but then the person on the other side could not see the update or conversation immediately. At the same time, the *software itself* was persistent and annoying to some users; it started automatically with Windows, and stayed in the system tray when minimized. Some users (for instance, Spencer Concord's mother) found this feature annoying; they did not want the tool on *all* the time.

The takeaway from these two points is that designing for persistence as well as resilience in spite of poor Internet connectivity may not be a sage approach to home help software design. Thus, Tech Clips, per se did not reduce the perceived burden of providing technical assistance. With different design choices, however, future pieces of software could be designed to support this types of usage. For instance, it might be more beneficial to have a piece of software that can be enabled or disabled as needed, and works well as a secondary information channel. For instance,

one might imagine having the equivalent of a "digital help phone call" session that, at a user's request, records and archives a remote helping session (e.g. by capturing webcam and/or screen content), then saves the content for future reference in a piece of software that looks like it's a "stock" Windows application.

Table 6.4: Tech Clips Appropriated as Video Voicemail for Family Communication

53s video:

[Adrian Austell, a nursing student, has just returned home from a long day at school. Her 1-year-old daughter, Nicky, is in her lap. Nicky is chewing on a large binder clip that she grabbed from the desk, but Adrian doesn't seem to notice.]

Adrian: "Hi Rachel and Amanda and Baby"

[Adrian looks at Nicky then points to the camera]

Adrian (to Nicky): "Say hi Nicky! Say hi! Look up there! Look!"

[Adrian repeatedly points to the camera, but Nicky doesn't look at it]

Adrian (to Nicky): "Stop, gimme that!"

[Adrian pulls the clip away from Nicky.]

Adrian: "I'm just getting' home from school. Hi Grandma, hi Grandpa, hi Uncle Milton…um, I dunno. I guess just here, hi everybody. We're doin' good. I don't feel well. I'm tired. And was getting' STUCK"

[Adrian holds her arm up to the camera]

Adrian: "I don't know if you can see my band-aid, but yeah, I been stuck by needles all day today, so, um, pray for me. I only got one more week left. Then I gotta take my BIG, one of my big exams out of four. So…I'll talk to you guys later. Bye."

In a slightly different type of usage, users in three homes (Austell, Decatur, and Marietta) appropriated webcam recording functionality (within Tech Clips as well as with standalone video recordings that were emailed) as a sort of video voicemail system to send messages to family members. For an example of this "video voicemail," please read the transcript provided in Table 6.3. Although this use of the software diverges from the research questions driving this study, it

seems that with slight modifications to the interface, Tech Clips may actually find uses as a tool for supporting remote-family communications about things *other* than technology.

6.6. **Reflection on the Thesis Statement**

Although Tech Clips was not used as I expected and hoped, as I progressed through this study, I learned far more about characteristics of home technology upkeep and maintenance than I had expected. In particular, this study revealed why, exactly, some difficulties persist over time rather than getting fixed. In CSCW, there is a term called *articulation work*, used to describe "work that enables other work" (Gasser 1986, Sawyer and Tapia 2006). In an early article on this topic, Gasser (1986) writes:

> Most studies of computing use question the problematic aspects of computing (e.g., "Why do errors (or some other problems) exist in computer systems and what can we do to eliminate them?") or try to demonstrate the advantages of new technologies. In this study, we have taken a different tack. We focus on the long-term, routine use of computing in organizations. Instead of studying how to eliminate problems or characterize advantages, we are attempting to describe and explain the dynamics of computer use over time. This leads us to focus on how circumstances persist and evolve, rather than why they exist in the first place. Some problems with computing persist over time, while others are easily and quickly eliminated. Why? For some users, high-quality computing persists over time, while for others, data accuracy…or some other aspect of computing repeatedly degrades as time goes by. Why? (p. 206)

Similarly to Gasser's writing, what I found through the Tech Clips study was not a quick fix to eliminating the errors that occur when people help their family and friends with technology problems. Instead, I gained insight into the articulation work that occurs within homes to maintain technological order. This articulation work can come in several forms, including changing one's work patterns to accommodate a system, taking on additional tasks, using computing in emergent ways, or avoiding the use of a technology completely. Thus, in the following two chapters, I

provide insight into the dynamics of technology usage in homes. I do not provide a technical solution to the problems that are in existence, but rather suggest why some problems persist despite clever technological efforts to make computing systems for the home easier to use and maintain. Specifically, articulation work can make or break the acceptance of technologies in a home, yet this type of work is frequently left unconsidered in the design of new consumer electronics and computing technologies. With the following two chapters, I hope to provide the additional insight into this important yet under-discussed articulation work that occurs in the home.

7. FAMILY FACILITATION CASE STUDY: THE DUNWOODY FAMILY

What sorts of articulation work occur to setup and maintain computing systems in the home? To answer this question, which was not part of my initial set of proposed questions, but emerged as an important consideration for this study, I employed the case study method (Yin 2003), generating nine case studies in total – one case for each deployment of the software. This technique was chosen because I was interested in what have been described as the "four goals of HCI case studies": exploration of novel problems or situations, explanations of technology use in context, descriptions of how a technology was used in context, and demonstration of how a tool was used.

In this chapter, I present a single case of a family that provides a particularly strong discussion point for discussing how existing patterns and practices of articulation work may impact the adoption of software tools for technical help. In particular, this family struggled with adopting the Tech Clips software due to their existing routines and beliefs about the role of technology in their lives. In Chapter 8, I provide a synthesis of findings across all of the homes based on the nine cases. Note that by adhering to the case study method, I am not intending to make claims of statistical generalizability with the data I have collected. Rather, I provide a rich description of phenomena that potentially expand to larger groups, but cannot make *statistical* claims about the generalizability of results; doing so would be beyond the scope of this dissertation.

7.1. Home Occupants

Steve and Janine Dunwoody are a couple in their mid-30s living in an affluent suburb north of Atlanta. Steve is a manager for an engineering firm, and Janine is a former elementary school

teacher who now stays at home with their two children, a 4.5-year-old girl (Allie) and a 1.5-year-old boy (Billy). They moved to the area several years ago, when Steve was transferred for work.

The Dunwoodys live in 1960s-era suburban ranch home with a brick front and a large front lawn. It is on a lot probably an acre or so in size. There are two beige cars in the driveway. The carport has no cars, but appears to be a children's play area. There are several large children's toys and bicycles scattered in the carport. The interior of the home, in contrast, looks like it is straight out of a home-decorating magazine. It's tasteful, neat, and has very little clutter—except for a somewhat hidden children's playroom, which had toys all over the floor, and television and speakers from Steve's bachelor days deemed 'too ugly' for the main portions of the house.

7.2. Technology in the home

The home is connected to the Internet using Cable Internet, and the householders exclusively use wireless connectivity for all of their computers. Unlike other homes I have visited, they do not seem to have any problems with wireless connection instability. As far as telephone service, there is no landline to the home. Janine and Steve use cell phones only. Steve has a Blackberry from his employer, and Janine has a low-cost LG flip phone.

They have two computers in the home, both laptops. Janine and Steve share a netbook, which is used throughout the house. Janine uses it for all tasks, except when she needs to print. When she prints, she puts items on a flash drive and then uses the second computer in the home.

This second computer, although a laptop, is permanently located in a spare bedroom. This room also is home to a printer and an external hard drive that holds all of their pictures and music. Steve uses this computer for homework associated with his part-time MBA program, and the couple's daughter, Allie (4.5 years old) uses this machine to play children's video games online.

The second computer is like nothing I have ever seen before. At some point, the laptop was dropped and the screen broke. Instead of discarding the computer, with the help of Phil, Steve's 24-year-old brother, they carefully re-crafted the base of the notebook into a desktop computer by placing the working half in a desk with a keyboard tray, and hooking it into an external monitor. The wireless antenna, which was located in the broken section of the laptop, was carefully extracted and physically stapled to the desk in an obscured location (See Figure 8.2).

As far as digital gadgets go, the Dunwoodys have a digital camera, one flat screen TV in the living room, and a CRT TV in the children's playroom. Steve used to be an avid video gamer and AV enthusiast, but largely gave those hobbies up once he had children; his "nicer" speakers are hidden away in the children's playroom, and his video game consoles were given to his sister. When it comes to buying new technology, Steve notes that his practices changed after having children. He notes that:

> it's more simplifying...because it's expensive to keep up with that stuff. And to be you know, the first one to have things or even, maybe not on the leading edge, but maybe earlier on the adoption cycle. So I don't really, I don't even research a lot. Because when you research then you want, right? Now it's by necessity, with the occasional, the occasional impulsive things.

Steve avoids thinking about new technologies because:

> Then you think you need it… it would be awful neat to have a picture on the wall that you can keep changing of all of your family photos. I could see doing that, but I just kind of try to stay away from it because then you don't know better.

Thus, the family attitudes toward purchasing technology seem to be reluctant at best; while everything they own could be described as "nice" equipment, there are not any frivolous purchases.

Everything has a purpose, and items are repaired such that they are usable and their flaws are hidden.

7.3. Sources of difficulty for them

Like the other homes in the study, the Dunwoodys had problems with viruses on their computers. Steve is somewhat concerned about security, but he is unsure about how real of a risk identity theft online is. Media and peripheral sharing also offers difficulties. As Steve remarks:

> I wish I could figure out a way to make it easy to take music from my iPod and put it onto my wife's. I know how to do it but I have to treat the iPod like an external hard drive. It's a pain in the ass.

Similarly, Janine uses a flash drive to transfer and print files created on her netbook. However, they have had other more subtle sources of difficulty. As previously mentioned, Steve, while first claiming that he is not a technology enthusiast, admitted during the individual exit interview that he likes having new technologies, but finds that learning about and buying gadgets conflicts with his role as a husband and father. Therefore, he tries to stay away from learning about or using new technologies because then he will want to have them.

Another source of difficulty for the family is keeping computers and equipment out of sight. Janine especially seemed concerned with having a neat and tidy house, and apologized to the research team many times for, what seemed to me, to be largely imagined clutter. She took clever steps to hide technology within the house. In the name of aesthetics, Steve's beloved AV system with very large speakers was hidden away in the kid's playroom because it was deemed too ugly. The living room featured tasteful, but lower quality speakers. Her father custom installed trim pieces to hide cable wiring (see photos in Chapter 8). Janine hid the cable modem under a dining room buffet, and surrounded it with knickknacks to make it blend in. With some pride, she

described the cable modem as "Fantastically hidden…you have to know where it is." When not using their netbook, it was stashed under a sofa and connected to a charger. This arrangement not only hid the computer from view, but also protected it against potential falls or rough-handling by the children. Given the family's past experience with a laptop that broke after falling off a couch, it is perhaps unsurprising that they would take steps to hide the netbook in a safe location.

7.4. Attitudes toward technology and help practices within the home

In this section, I describe each family member's attitudes toward technology and helping practices within the home, and reaching beyond the home.

7.4.1. Janine

Janine considers herself to be a person who if she's "confident in how to do it then I'll do it myself." She has tackled plenty of home repairs on her own, including removing wallpaper and wiring light switches and plugs (her father, an electrician, taught her over the phone how to wire them). When she asks for advice on how to do a task, she will write down instructions. But computers are different. She just is not into them. Janine says:

> I know enough about technology to get by. That would kind of sum it up….I only need computers for what I need them for. I'm not interested in taking the time to expand myself beyond that.

Similarly, Steve described Janine's typical experiences with computers as "a lot of yelling. Frustration, yeah, big time." He thinks her response is because she does not use computers enough to get over the learning curve. He remarks, "The more you use it the easier it is. And the more predictable things are." She does remark during an interview that if she sees a *purpose* for what she is doing (e.g. if she found computing applications that helped her further her photography hobby), she would consider learning more.

When it comes to providing technical advice, Janine quickly said, "Nobody would ask me for technical help." Then later in the interview, she said she would, on second thought, help the very young and very old, for instance, Steve's mother, because "She's more computer challenged then I am. But really, nobody would ask *me* for help with computers. And I'm ok with that." Janine says it is a generation gap issue, that Steve's mom does not know how to download pictures from cameras or use Facebook:

> We'll help but then she'll ask again…It gets a little frustrating, because it doesn't go in. We just, she's basically asking us to do it for her all the time. So what I, what I would do in that situation would be if, when I told her, and now I know this about her, when I tell her, I would write it down and I would write it down really simple terms for her. So she would have the information and then not have to ask again… [but she still asks].

Allie, her pre-school age daughter, will ask for help with the computer, but Janine dismisses this as providing "technical help." Steve describes these interactions between Allie and Janine as Allie in tears, crying "MOMMY WHY WONT THIS WORK!? AAAHH!" Janine says that Allie will say things such as "Mommy! This game is too hard. Come and help me play. Teach me."

Janine does not call tech support "because I have people in my family who are my tech support." Her first resource for getting assistance with technology problems is her husband, because he is the most readily available to help. Her second choice is Steve's brother, Phil. Phil is 24, and well known as the technical geek of the Dunwoody family. Conveniently, he lives a few miles away. Steve and Janine will ask for technical help such as removing computer viruses in return for providing a meal or beer. Janine describes their relationship as "He's like our Geek Squad to fix our computer…I have to feed him dinner." Steve says that Phil "complains about it, but he fixes whatever it is."

Janine also gets help from her father, an electrician living in another state. Janine describes her dad as "not so much the virus kind of, cleaning it off the computer guy. He's the behind the scenes wiring guy." Her father helped them rewire the cable jacks in their home, and taught Janine how to do basic electrical work, such as installing light switches and plugs by instructing her over the phone. Janine says she has a "daddy-do" list when her father visits for fixing things (technology related and otherwise). Says Steve, "She puts things on my list, and they don't get done, so it gets transferred to his list."

Janine, while relying heavily on others for technical assistance, is well aware of the burden she places on her helpers. In the final visit at her home, she said:

> It happened this morning. My email didn't work. My email's not working today. And I don't know why, and it says, report your problem to Hotmail. I don't, I didn't do that. I would rather ask one of them [Steve or Phil] first, but I didn't want to bother them. So I turned the computer off and ignored it…I think I feel like I'm bothering people when I ask for help all the time. I feel like, nobody ever comes to me with questions. I'm always the one asking other people, so I'm never giving back.

She mentions that there are many occasions where she could ask for help, but chooses not to, because she does not want to "bother" her helpers. In summary, Janine, while not afraid to take on other sorts of technical tasks, such as rewiring electric systems in a home, does not have this attitude when it comes to computers. Although she will help her daughter and mother-in-law with very basic problems, for the most part, she is not enthusiastic about computers, nor does she want to learn more about them, or in some cases, go out of her way to ask for assistance when needed.

7.4.2. **Allie and Billy**

Of their children, neither toddler Billy nor preschooler Allie are computer savvy. Steve describes Allie as "old school," a typical child who plays with dolls and other traditional children's toys. She

does not know how to turn on the TV and has to ask her parents for help. However, Steve has helped Allie learn the basics of the computer. He says:

> She figured out the mouse. It's still a bit tough for her. Like she doesn't, she moves the mouse, lifts her hand up to press the button, right? Versus just pressing the button. I put a little sticker on the button to try and like show her where it is, you don't have to move your hand, whatever. But she doesn't…

Steve also showed Allie how to play a web-based kid's game online. He describes this experience as "pretty cool," and was excited that she was learning how to use a computer. When she first began playing the game, he would have to help her, but as time progressed, she specifically asked to play the game by herself. Remarking on how Allie, at a young age, copes with technical problems, Steve says

> She just wants to know why a game won't work. It's less about the higher level complications of "why is the internet connection not working?"

Although Steve was thrilled about Allie's emerging interest in the computer, when we asked Janine individually about her attitudes toward Allie and the computer, she had a more hesitant attitude toward her daughter's use of technology. Said Janine:

> We want her to know what computers are and we want her to be able to use the mouse and use the keyboard but we don't want her to be sitting on the computer all day…all of the expectations of what a four year old should learn, she knows.

In summary, the children in the home were just beginning their explorations of computers. They did not play any major role in the upkeep of technologies within the home.

7.4.3. **Steve**

Steve describes most computing technologies as "predictable" and does not tend to read the manuals that come with items such as iPods because they are "more and more plug and play." When he is interested in a gadget, however, such as his television, he avidly read the manual because "I was very interested to dig into all the little features, to find out what they were." Similarly, Janine described Steve as having:

> A pretty good understanding of it [technology]. And if he doesn't have an understanding of it, for the most part, he will try to figure or try to go to people who can figure it out…learn how to do it on his own.

When it comes to fixing things (broadly), Steve says

> I think I want to be a do-it-yourselfer... [But] I pay to have things fixed normally. Or I'll give it one or two hours. I'm not willing to spend a whole Saturday going through trial and error on how to fix my plumbing. So I'll spend a couple of hours. If I can figure it out, great. If not, I pick up the phone.

When he has computer problems, he will use a search engine first. He says he will type in queries such as "why won't ___ happen?" or "how do I fix _____?" He will also rely on search engines to find out about new products (for instance, replacing his cell phone). When search engines do not help him solve his problem, Steve then turns to his younger brother, Phil. Even though Steve knows that Phil does not enjoy helping him, he prefers asking Phil to calling tech support lines, because "what drives me crazy is you sit on hold." He has had some instances where he does not trust Phil's advice, and asks other people to triangulate what Phil tells him. A neighbor who works in IT occasionally serves as this secondary source of advice. In particular, Steve described a situation in which he did not trust Phil's advice about virus scanning software. Said Steve:

> [Phil] does things that aren't always legal, downloading a video, or streaming video… with the virus software, he was recommending that I use this A—something-something….[there were] pop-ups all over the place the next day…I asked my neighbor about it, and he's like, You're a Bank of America customer, right? Well if you go there, you can download Norton free for a year or something, so I did that instead

Steve, while not as technical as his brother Phil, provides help to females in his family. He provides help to Janine because "she always asks me first." Occasionally he helps his sister and his mother, too. Although Phil, the younger brother, is the well-known family technical expert, Steve helps his mom with using technology, such as helping her put music on her iPod, or using Skype on her computer. Steve helps rather than Phil because:

> Mom doesn't like asking my brother because he gets mad at her, so she asks me. He grew up in the house with computers, and she'd always be asking him things and forget it. Or wouldn't write it down and she'd ask him again and again and just drive him crazy. So there's just baggage there…I try to help, but I don't know half of what he knows, but I can explain better.

Janine, in agreement with Steve, described Phil by saying "he's not a teacher." In the entry interview, Steve remarked on the gender differences in the list he created of people who he helps and asks for help. When looking at the list of the people he helps, he said aloud, "As I'm writing this, they're all females. Does that say something? Not bad, but just…." To this, Janine responded, "It also says that you're a good teacher and that people go to you because you're patient with them and you explain it rather than just doing it."

What I found especially interesting about Steve is that while not describing himself as a technology enthusiast in front of his wife, told us a different story when he was alone. He got into computers when he was 11 or 12, when his computer enthusiast uncle bought him a machine. He "remembered as a kid writing a speech on like RAM and ROM" and being interested in computers. However, he took a programming class in college and did not enjoy it, and drifted away from these

interests in favor of audio-visual systems and video games. He had a Playstation 2 until he had kids, stating, "There's no time [now]", so he gave the console to his sister.

7.5. **Study Tasks**

At the conclusion of the entry interview, I left the Dunwoodys with a box of equipment and a logbook with seven "homework" tasks for the week. During the first week, they could divide the tasks in whatever way they liked best. In the logbooks, they recorded what they did, any help needed, and they completed the NASA-TLX scale assessing perceived frustrations, performance, effort, and demands of the task. In weeks two and three, the participants also completed questions asking about expected and actual difficulty of the task, prior knowledge about the task, and the amount of time the task took to complete.

At the end of the first week, I visited the home again to collect the week 1 logbook, and then left another box of equipment and a new logbook. This second logbook contained 11 tasks of varying degrees of difficulty. This logbook contained instructions that *Janine* should complete the tasks. This choice was made to disrupt the normal technology maintenance practices within the home, to learn about what's normal and what is not, and to ensure that Janine tried tasks rather than just immediately turning them over to Steve. In retrospect, I was unprepared for the response I would get from the Dunwoodys (and other families) about this choice of study design.

In week two, Janine first tried to do the iPod task, but became overwhelmed by the instructions that came with the iPod, which she read cover-to-cover before actually trying out the device. After an hour, she abandoned the task. A few days later, Steve (not Janine!) called me to discuss Janine's difficulty with the study. He told me the tasks were too hard for her, and the family was considering quitting the study due to the amount of perceived time it was taking ("It amounts to less than $10 an hour, which isn't worth it").

To keep the family enrolled in the study, I reduced the total number of tasks for them as compared to the other households, and assured them that they did *not* need to *successfully* complete all tasks in order to receive the bonus gratuity for attempting 75% of the tasks in the study. I also told them that Janine could work on her tasks during week 3, while Steve also completed his set of tasks.

After this phone call, Janine re-attempted the iPod task and completed it successfully. At the final interview, Janine apologized to me for getting angry about her response to the iPod task, and told me that by reading the instructions so carefully, she had over-thought the task. In the end, she found the task was not nearly as difficult as she had imagined; her computer automatically detected the iPod.

7.6. Use of Tech Clips

Tech Clips was installed on the couple's netbook, but not the laptop-turned-desktop in the spare bedroom. Since the Dunwoodys had separate accounts on the netbook, they each had their own login. In the initial home visit, they created a test video and text-based message in the software. I instructed them to use the software for whatever purposes they felt were appropriate, including—but not limited to—giving and receiving technical help. I also informed them that everyone could see content on the system, so to be thoughtful about whom they chose to join the system.[13]

Overall, the Dunwoodys did not embrace Tech Clips. In the first interview, when I provided them with gift bags and information cards to give away, they immediately began asking about the minimum number of people they would have to invite. They remarked that recruiting

[13] Based on his logbook responses, it seems like Steve had misunderstandings of how Tech Clips worked. The broadcast mechanism wasn't that clear to him. This could be because the system created an automatic "Welcome!" thread for each person who joined, he may have thought that this was a way to talk to that person.

their family and friends "feels like you're selling something," and Janine seemed concerned about spamming and burdening people. During the end-of-study interview, Janine and Steve told me that they tried to invite people, including friends, family, and neighbors, but their invitations were ignored. They said, "We asked like ten people and we thought some would say yes but they said no." These non-joiners gave no reasons for their lack of participation.

Of these ten people they reported inviting, system logs show that Janine invited four people using the interface within Tech Clips that sends a personalized email link to potential users. Janine reported during a visit by the researchers that she immediately followed up with personalized emails to the people she invited, with more explanation of what the software was. Janine also noted that she found it challenging to invite people when she did not have a fully developed concept of the purposes for which she should use the software.

One person joined the system: Janine's brother, Jake. Jake never posted content other than the automated "Welcome!" message created upon joining. Log data from Tech Clips shows that Jake viewed content in Tech Clips twice: when he first installed the software, he attempted to watch a video. The video failed to play; it appears that Steve had tried to create a video in the "Welcome Jake!" message, but it did not record correctly, likely due to problems connecting to the streaming video recording infrastructure hosted at Georgia Tech. On a second occasion, Jake read the content of the thread Janine posted explaining what MAC address filtering is. The software stayed active on his computer during the entire three-week period of the study, however.

The family's use of Tech Clips was largely limited to what was required of them based on the design of study tasks. In the post survey, Janine checked the following boxes indicating why she didn't always post on Tech Clips: *nothing to say, didn't know how to phrase the question, felt shy, didn't have time, it was easier to use another method, takes too long to get an answer, not enough people using it, and*

responses might make me feel dumb or bad about myself. Steve checked these boxes: *got what I needed without posting, takes too long to get an answer, and it was easier to use another method.*

Janine described the lack of audience in Tech Clips as frustrating. She wanted to post information that would be useful to friends and family members, but she perceived that the only person who joined—her brother—would not find what she posted of any use; the people she thought would benefit from the system were not joining. However, she could not see from the log data that Jake *did* read some of her content in Tech Clips.

In week 3, there was a task for participants in which they were asked to create a webcam tutorial based on any of the tasks they completed in the study. Steve created a tutorial for his Jake, describing how to edit a Wikipedia page. He recorded the tutorial twice, ending the first one with the line "Oh my god, this is gay" (whether it is the task or the tool that is gay, I am not sure).

7.7. Implications for the Design of Tools for Socially-Provided Technical Help

The Dunwoodys had established ways of participating in technical help. They had conflicted opinions of how to engage with technology; Steve's former enthusiasm for electronics had long since faded. He is a busy person who "deals with other people's problems all day" as part of his job as a manager. He is also a part-time business school student; having a balance between work, school, and home life is a challenge for him.

When it comes to having software tools that could help people becoming more effective and reducing the burden associated with technical support in home settings, Steve desired having a repository of the most common problems householders may face. Nevertheless, it is not clear he would *contribute* to it. Steve describes his days at work as "fixing other people's problems," and he has no interest in inviting himself into situations that force him to fix even more of them.

Furthermore, he described an extreme dislike for the "ego driven" and "negative" people—as well as spammers—that he perceived as being the primary contributors to online technical forums.

Steve provides technological help solely out of his role as a son and a husband; he mentions that he feels obligated to help his mother because she and his technically skilled brother get frustrated with one another when she asks for help. He is not the type of person who is going to go out of his way to provide technical advice to anybody and everybody. This commitment to social roles is an unspoken source of tension. During the individual exit interviews, Janine and Steve were separately, and out of earshot of one another, shown a series of speculative products that could be used to give and receive technology help. One was a phone-based text messaging system in which family members could be connected to notify one another about technology problems and needs. Janine was enthusiastic about the idea of being able to text message Steve questions she might have about technology. However, when the same concept was presented to Steve, he was strongly averse to it, because it would be yet-another opportunity for him to be saddled with "other people's problems."

However, what if we considered software systems from Janine's perspective? From her experiences, we come across a much different set of concerns and opportunities. Janine's commitment to fixing and repairing items and simultaneously keeping the house tidy and orderly means there is little room for computing besides what is absolutely needed in their lives, so there are few instances to learn about new technologies. Janine also has a strong support structure. Her husband, brother-in-law, and father are all available for assistance with technical problems. This support structure, however, is also a handicap. For most of her life, she has never had much opportunity to struggle with technology and realize that what she thinks are mountains of technological difficulty are merely tiny bumps in the road. Left to her own devices, Janine is not going to *want* to become more effective or confident with technology. However, Steve noted that

being in the study, in a situation in which their normal routines were disrupted, was ultimately positive for her, because it showed her that performing some technology-related tasks were not as difficult as she initially perceived them to be.

Even though she does not want to become a technical expert, Janine worries about being a burden to those around her when it comes to technology help. She also thinks she has nothing to offer when it comes to technological advice, so as to even out the give-and-take of asking for help. If she could become aware of having an audience—and get feedback that her audience finds her experiences and advice worthwhile—that may be a positive experience that could raise her confidence.

In particular, Janine's experiences with posting content on Tech Clips suggest a few principles for designing social help systems that encourage confidence. In one task, Janine posted instructions about how to change information on a Wikipedia page. However, she thought that posting this knowledge would not be of use to anyone in the system (e.g. Steve or her brother). She did not realize, however, that other more technically skilled people—e.g. Steve—initially might have held a perception that this task is difficult. Perhaps if Janine could see what others *do not* know, that would be empowering for her. Secondly, if Janine could see that others were reading her content (e.g., Jake read her post about MAC address filtering), she would realize that she has something that is interesting to offer. Getting Janine to contribute content, however, might be difficult. Janine likely will not break out of her normal role of being a "technically challenged" person unless forced to do so. Nor will she tinker with technologies unless "it appealed to me like Photoshop or something like that."

7.8. **Summary**

In this chapter, I described a case study of one of the ten families that participated in the Family Facilitation study, showing how characteristics of the family's technology routines and beliefs may provide challenges to the design of software for assisting with technical help giving. In the following chapter, I provide a synthesis of issues found across homes in the study.

8. ARTICULATION WORK AND HOME TECHNOLOGY

In this chapter, I describe more fully the results of the Family Facilitation Study. Via this study, I provide additional richness to the findings described in previous chapters about Research Question 2. Recall that RQ2 is: ***"What mechanisms are householders using to cope with these difficulties and what are their motivations for choosing these mechanisms?"***

Although prior studies by others, as well as my earlier work, have identified a broad range of reasons for technology problems in residential settings, these studies have relied on primarily on *retrospective* accounts. A more limited body of research examines the specific problems householders encounter in-situ (McDonald *et al.* 2008), however, this work is limited to understanding the experiences of *individuals* installing and using *digital media storage devices*; it does not examine within-household coordination or divisions of labor within the home, nor does it examine problems extending *beyond* digital media storage.

Through the *Family Facilitation Study,* I provide a set of findings that offer detailed and specific information about problems householders encounter when setting up and maintaining residential computing environments, that is, the articulation work that is required to keep a residential computing environment in working condition. For instance, technology acquisition habits, the co-existence of managed (corporate-owned) and unmanaged (householder-owned) equipment, and specific symptoms of network problems influence which mechanisms householders use to cope with technology difficulties they encounter. Furthermore, to provide an extension to the work presented in Chapter 4, I uncovered more in-depth knowledge about the points at which people will transition from trying to solve problems on their own to calling in outside resources, whether a person in the home, a knowledgeable friend, or a professional technician.

By having householders install and use a piece of software intended for the giving and receiving of technological help to family and friends, I was able to better understand the dynamics of help at home that offer challenges and opportunities for the design of software for technological help-giving. Following those sections, I provide broader implications for the design of software tools intended to facilitate communications about technical issues.

8.1. **Help-Seeking at Home**

In Chapter 4, I discussed methods and motivation for participating in informal technical support. Through the *Family Facilitation Study*, however, I was able to understand more about help-seeking strategies in-situ, based on real situations. In particular, I learned more about the ways in which people decide whether to engage in computer self-help (e.g. tinkering or looking up info online) or decide whether it's time to turn to others for assistance.

Help seeking is an act that requires some amount of vulnerability. Asking for help can be upsetting, uncomfortable, or embarrassing to an individual. When one asks for help, he or she potentially risks rejection or negative judgment by others; psychology literature on helping suggests that "nothing makes you feel worse than making a fool of yourself in front of others" (Shapiro 1983). Similarly, being asked to provide help can elicit a range of emotions ranging from pride to annoyance to vulnerability. The help-seeking literature suggests that there may be gender differences when it comes to giving and receiving help. Lee (Lee 2002) notes that in Western cultures, females may be more likely than males to seek help (for all sorts of problems, not just technical ones). Says Lee:

> Men are socialized to value competence and one-up-ness whereas women are socialized to value relational closeness and interdependence. Developed since early childhood, these values become an integral part of how men and women perceive themselves being competent, superior and

> independent may therefore be more important to male self esteem than to female self esteem (Lee 2002)

Similarly, in an examination of health-related help seeking, Addis and Mahalik describe the body of literature on men's help-seeking as "strikingly consistent…as a group, men of different ages, nationalities, and ethnic and racial backgrounds seek professional help less frequently than do women" (Addis and Mahalik 2003). They also examine how gender-role socialization may influence whether men choose to seek help, by examining both masculine ideologies (e.g. belief systems about being male) as well as masculine gender-role conflict (that is, negative consequences of adopting a particular masculine ideology). They argue that actions surrounding help seeking including admitting inadequacy and relying on other people "conflict with the messages men receive about the importance of self-reliance, physical toughness, and emotional control." The authors identify several questions that influence whether a man might ask for help. These include whether the problem is considered "normal," whether the problem is core to one's identity, whether there will be opportunity to provide reciprocal help, whether others will react positively or negatively, and whether anything will be gained or lost by asking for help.

Indeed, these patterns emerged within the homes I studied. I saw two distinct patterns of help seeking. The first, which could best be described as a pattern of learned helplessness, and most frequently used by females who were in the study, is one in which householders *immediately* asked someone else for help, or else gave up on a problem in hopes that it would resolve itself. This was the technique used by those most intimidated by technology (including Janine Dunwoody, Deedra Lithonia, and Eileen from the pilot study).

For people with a higher sense of technological self-efficacy, they would attempt to either read manuals that came with devices or tinker with items. If these approaches did not work, the first stop for getting technical help was the Internet. Study participants described that when

looking for information about how to setup an item, or why something didn't work, they would either go directly to a manufacturer's homepage, or else they would use a search engine, usually typing in phrases such as "canon wifi printer setup" or "Why won't ____ work?"). Participants were not particularly discriminating about which search engine results they used; when I asked them which technical help forums they preferred, they could not name which ones they visited. All technical help forums looked the same to them. The only exception to this situation was when looking up product reviews; in this case, cnet.com or about.com were most frequently seen as trustworthy resources for this sort of information.

If these self-help approaches did not work, the next step would be to leave the item alone, usually overnight. After leaving the item alone, the householders would try again, give up, or reach out to others for help. Men in the study were far more determined to figure out problems for themselves rather than seek help from people. The women were far more comfortable reaching out to family members, coworkers, knowledgeable friends, or students/teachers (if they were in an academic setting), That's not to say that men would *never* ask for outside help; rather they seemed far more determined to figure out problems on their own before admitting they needed assistance.

Just as in the *Help at Home* study described in Chapter 4, help from one's social network was typically preferred over help from paid technicians or manufacturer help lines. However, if no one was available from the social network, or the problem was perceived to be one that members of the social network could not possibly solve, at that point, householders would then seek professional help.

8.1.1. **Patterns of Help Provision**

In this study, I was also interested in learning more about how people *provided* help to others within their home, as well as to other people they knew. Householders overwhelmingly reported that

they assisted people who were older and new to computing. As described in Chapter 6, Steve and Janine Dunwoody would assist their parents with simple tasks such as using Facebook. Roy Marietta helped a friend new to computers set up their email, and would assist an elderly uncle in another state with using communication tools such as email and Facebook. Jamar Lithonia assisted his elderly aunt, who had vision problems find ways to use a computer in ways that met her needs. Spencer Concord, although he did not enjoy it, would provide technical assistance to his mother, as well as his fiancée's parents. He described providing this help partially out of guilt and commitment to his family, but also because he did not like to see nice computer equipment being treated poorly.

8.1.2. **Female Technical Leads**

Literature in social psychology suggests that there is a difference in how men and women provide help. According to the literature, women are more likely to provide help with the daily, mundane needs of others, particularly with people whom they have long-term relationships. Men, in contrast, are more likely to engage in "hero" behaviors, in which they have an audience, risk themselves personally, and save someone in crisis; men are also more likely to engage in "chivalrous" behavior, where they attend to the needs of the vulnerable and weak (Eagly and Crowley 1986).

In the houses in which females took lead for computer maintenance tasks (Austell, Cascade, Decatur, and Woodstock), these occupants did *not* participate in helping outside of the home, e.g. performing routine "digital housekeeping" when visiting relatives or otherwise offering people unsolicited help. Although literature from psychology suggests that women are more likely to engage in mundane sorts of help, what makes mundane, routine technical help different? Why

this pattern emerged is intriguing, and worthy of additional study in the future. Is it perhaps that providing help to people outside of the home is a form of digital chivalry, a distinctly male activity?

8.1.3. **Being on the Receiving End of Family Help**

Participants who were on the receiving end of family provided help, however, were not always positive about these experiences. Most vividly, Nyree (Pilot study), described how she did not like it that members of her family would upgrade and clean up her computer for her. When her husband and son performed routine digital housekeeping tasks, they would inadvertently remove things such as Internet browser bookmarks or shortcuts that she used to navigate her computer and the Internet. Despite being very cautious of protecting herself from dangers on the web such as viruses, she did not understand the purpose of security-related necessities such as software upgrades. Instead, she wished that systems were not upgraded to the latest-and-greatest versions—she was perfectly happy with older versions that she knew how to use.

Similarly, Spencer recounted a somewhat similar experience when he installed the Tech Clips software on his mother's computer during the study. His mother did not understand what the software was for, and every time her computer booted, Tech Clips would start when Windows booted up. She became angry and frustrated with this situation; she found the software popping up upon booting to be annoying, and demanded that Spencer remove it after a couple of days.

The perspectives of Spencer's mom and Nyree suggest that forcing things to make one's computing experience better—such as automatically upgrading software or providing new ways to give and receive help—may not work well. Instead, those who would benefit from software systems for the provision of technical help may, in some way or another, be persuaded that these systems will be of use to them. Similarly, it also suggests that people who are *providing* technical

help may be well served by both understanding and respecting the needs and preferences of people who do not share the same technical enthusiasm or expertise they do.

8.1.4. **Divorce and Family Technical Support**

When the structure of a family changes, technology maintenance practices and resources for advice may change, too. This is another point worthy of discussion. Statistics on marriage and cohabitation show that nearly at least a quarter of all marriages in the United States end in divorce within five years; couples in second (or later) marriages, minority couples, as well as unmarried cohabitating couples are even more likely to split up (Bramlett and Mosher 2002). When these relationships sour, it can affect technical support practices in the home. Given the frequency at which relationships dissolve, these situations may be considered—in the long term—to be both normal and worthy of consideration when designing systems that support home technical maintenance practices.

In the Cascade home, Viola relied on her electrical engineer husband to perform computer and electronics support. Because he was always available to fix problems, whether mechanical or electronic, she never had to think about these issues. When the couple divorced, however, support practices within the home shifted. Viola and her three daughters had to take on the technical work that the father had previously provided.

For instance, Viola described to me how she had to learn how to install speaker cable wiring on her own, because she did not have anyone else to do it. Although she had never performed the task before, and thought it was intimidating, once she actually tried it, she remarked that it was much easier than she had perceived it to be.

The middle daughter, Keisha (18), took on responsibility for setting up and maintaining the wireless computing infrastructures after the divorce. Keisha was the most logical choice for this

role and fell into it; when the couple was married, Keisha would follow her father around while he was fixing things (electronics or otherwise). When she shadowed him, she would ask questions about what he was doing, and sometimes participate in the tasks as well. Thus she was the most prepared to take on these tasks once he was no longer in the home.

After the divorce, the father still served as a technical reference to the daughters. The girls would phone him for technical advice. Keisha remarked that for some of the post-divorce maintenance tasks she did, her father would coach her over the phone of how to do them. More recently, he also helped her select a new laptop for college. Viola, however, excluded herself from this resource. Her daughters served as a conduit to the father's advice, but she would not ask him for help directly.

What these statistics about family structure, as well as the experience of the Cascade home suggest, is that when thinking about how to support families engaging in technical support, it is important to think about how to support transitions in who provides technical support within the home in situations where a help-provider is no longer available for whatever reason. However, it also suggests that shifts in family structures may present opportunities for householders to become more confident in engaging with technical infrastructures, as they may be forced to be in situations in which they have no choice other than to learn and become proficient.

8.2. **The Home Technology Ecosystem**

In this section, I describe how the study households acquired computers, modified them as appropriate, and dealt with technology at the presumed end of its life cycle. I also describe steps householders would take to maintain technological order within the home.

8.2.1. **Acquisition Habits**

Technologies within the home are acquired for a number of reasons; the most common reasons householders purchased new computers were due to planned replacements every so many years, or due to life events that dictated additions of new technologies (e.g. going to college). Who is responsible for decisions about technology purchasing varied among the homes; in some houses, computers were a jointly decided purchase because of their expensiveness. In others, occupants deferred decision making to a single person. For example, in the Lithonia and Pilot (Nyree) homes, husbands selected which technologies to purchase without consulting their wives, as the wives were largely uninterested in this sort of decision-making.

Intuition might tell us that <u>householders</u> are responsible decision making about the types of technologies that enter their home. However, a counter-intuitive pattern emerged in this study: *Householders are not fully in charge of selecting devices that enter their technology ecosystem. Other people can and do implicitly make crucial technological decisions for them.*

For example, technologies entered homes due to (sometimes inappropriate) gift giving. In the Smyrna home, Jessica had received expensive electronics selected by her father. These gifts, while high quality, were often too advanced for the purposes she needed; most recently, she had received a professional-grade digital camera and lens set, which was far beyond her photography abilities. The only way she could make use of the camera was to let a photography guru friend borrow it. Similarly, in the Decatur home, the children's grandmother would buy the grandchildren computers and other electronics for birthdays and holidays, even though they did not ask for or necessarily want them. Within-home gift giving can also bring technologies that are not used much; Jamar Lithonia bought his wife Deedra a digital music player as a gift, but she refused to use it after trying it a single time and getting confused by the interface.

Acquisition of home technologies can also be opportunistic in nature. In homes where employer-provided laptops were used (Smyrna, Cascade), the users had machines that were standard issue from their workplaces. Householders also, at times, took on cast-off technologies from someone else. Adrian Austell received an old laptop from her father when he upgraded his own, and in the Woodstock home, the couple took in a malfunctioning laptop that Cindy's parents thought was beyond repair. Cindy, an adult education teacher, brought the laptop to her school and had a technically skilled student fix it for her so that it was like new again.

8.2.2. **Device Lifespan: Longer than Expected**

Once devices enter the home, they may have a longer lifespan than expected. In the Lithonia and Marietta homes, for example, household finances explicitly dictated when purchases occurred; given both home's reliance on irregular income sources (real estate sales/mortgages and contract work respectively), the homes rarely made electronics purchases. In other homes, occupants waited until their computer's performance degraded sufficiently enough to convince them it was time to purchase a new machine.

In the Dunwoody and Marietta homes, the householders also held a strong regard for *devices that last*. They chose to fix rather than discard items, and took time during the interviews to discuss steps they had taken to keep items in working condition when others would have thrown them away. For example, at the Dunwoody home, their laptop fell off a piece of furniture onto the floor, destroying the LCD. With the help of Phil, Steve's brother, Steve refashioned the laptop into a "desktop" machine that (quite literally) was fastened into a computer desk. To enable wireless internet on the new "desktop" machine, Phil removed the wiring for the laptop's wireless antenna (which had run through the section that was destroyed) and stapled it to the bottom of the desk.

Figure 8.1: Laptop reborn as desktop

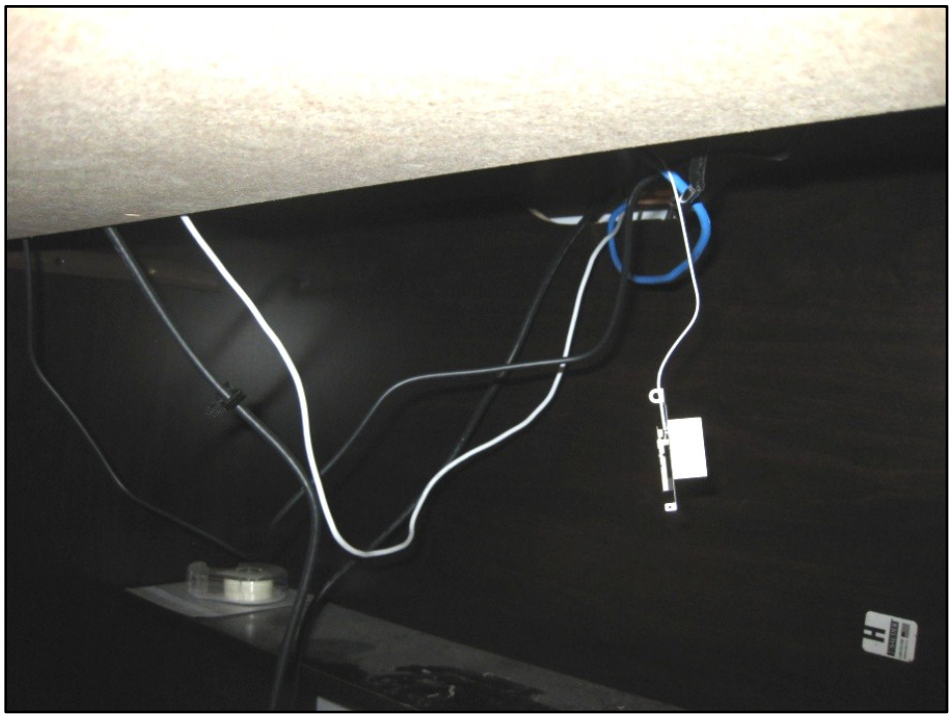


Figure 8.2: Making Wireless Work

At the Marietta home, Roy's freelance work required staying in touch with existing and potential clients. Roy's approach to maintaining his list of contacts was to keep an aging Dell Axim PDA from his previous job as an "electronic rolodex." The PDA would not synchronize properly with his computer, but it was permanently perched atop his desk in a charging cradle. Roy was planning to upgrade to a smart phone eventually, but given his somewhat irregular income stream, he was not in a position to upgrade to a new phone and get rid of the PDA.

Figure 8.3: Roy (Marietta) relies on an aging, broken PDA to manage his home business

Karen and Roy in Marietta also took time to discuss the preference for owning long-lasting items extended into other areas of their lives. They showed me antique furniture they owned and loved, and Karen, who was previously married before she met Roy, described to me how technology played a role in their engagement. As an engagement gift, Roy gave Karen a 486 computer,

because he could not afford to purchase a diamond ring nicer than the one she had from her previous marriage, and "at least this way I'd have something that lasts."

8.2.3. **Antiques and Technological Graveyards**

Even after usefulness faded, householders kept old computers and electronics within the home. Although these devices may be virus laden, missing pieces, or otherwise malfunctioning, householders kept them within the house, typically in a closet-based "device graveyard." These devices were either held onto because of sentimental value (as Jamar in Lithonia described it, "this was my baby that went all over the country with me", held extensive digital music libraries, or had important data that one day might get transferred to a working machine. It should be noted that householders did not have any specific plans of when or how they would transfer this data; it was just described as something that would happen someday.

Figure 8.4: The "Computer Graveyard" in the closet of the Cascade home

Finally, in the Decatur home, Jillian described that she intentionally kept boxes filled with old technologies stored away so that when she had grandchildren, she could show them technological heirlooms.

Figure 8.5: Technology Heirlooms; old film and digital cameras (left) and bag of cassettes (right)

8.2.4. **Maintaining Order and Neatness in the Home**

Prior work (Grinter *et al.* 2005) described how householders to steps to hide cabling and components associated with computers and electronics. The households in my study provide further evidence for these practices. The families in this study also took steps to conceal cords. In the Smyrna/Concord house, this choice was pragmatic; their home was for sale at the time of the study, and their real estate agent strongly suggested that they hide away any computer clutter. Hence, the room in which most of the computing equipment stayed was immaculate.

In the Dunwoody household, Janine and Steve had, at some point, reversed the location of the living room and dining room in their older suburban house. What had previously been the living room, prewired for cable TV, became a formal dining room. Conversely, the dining room was converted into a living room that was home to a large television. The hardware for the cable modem remained in the (new) dining room. Janine, however, hid the hardware under a buffet, with jugs of various sizes artfully arranged around the computer components.

Figure 8.6: "Fantastically Hidden...You have to know where it is"

Providing wiring for cable television into the former dining room proved a challenge, but Janine's dad, an electrician, wired cable access for the television, and hid the cables under painted trim down the wall, then stapled the cable to the baseboards.

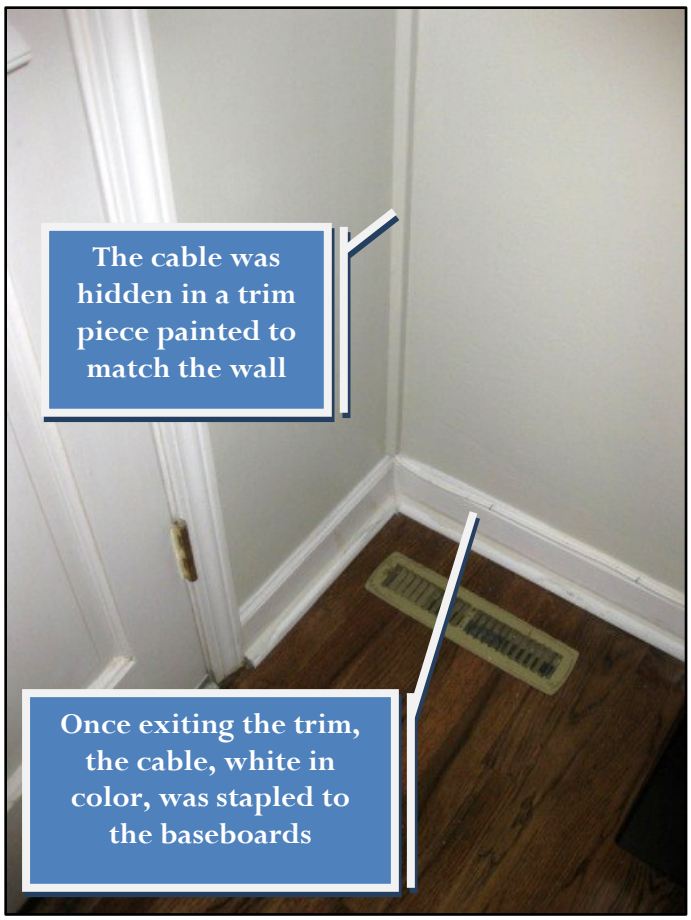


Figure 8.7: "We actually had to drill a hole to get the cable in that room...but you'll never find it"

In contrast, Adrian Austell lived in a rented apartment and could not make modifications to cabling or her walls. Her cable modem and wireless router were on the living room floor, with wires running from a cable jack behind a TV stand. As Baby Nicky began to walk and explore, she also developed a habit of pulling cords out from the cable modem and wireless router. Adrian's solution to this problem was to place a baby bouncer that Nicky had outgrown over the equipment so that she could not access it (the bouncer was too heavy for Nicky to drag out of the way).

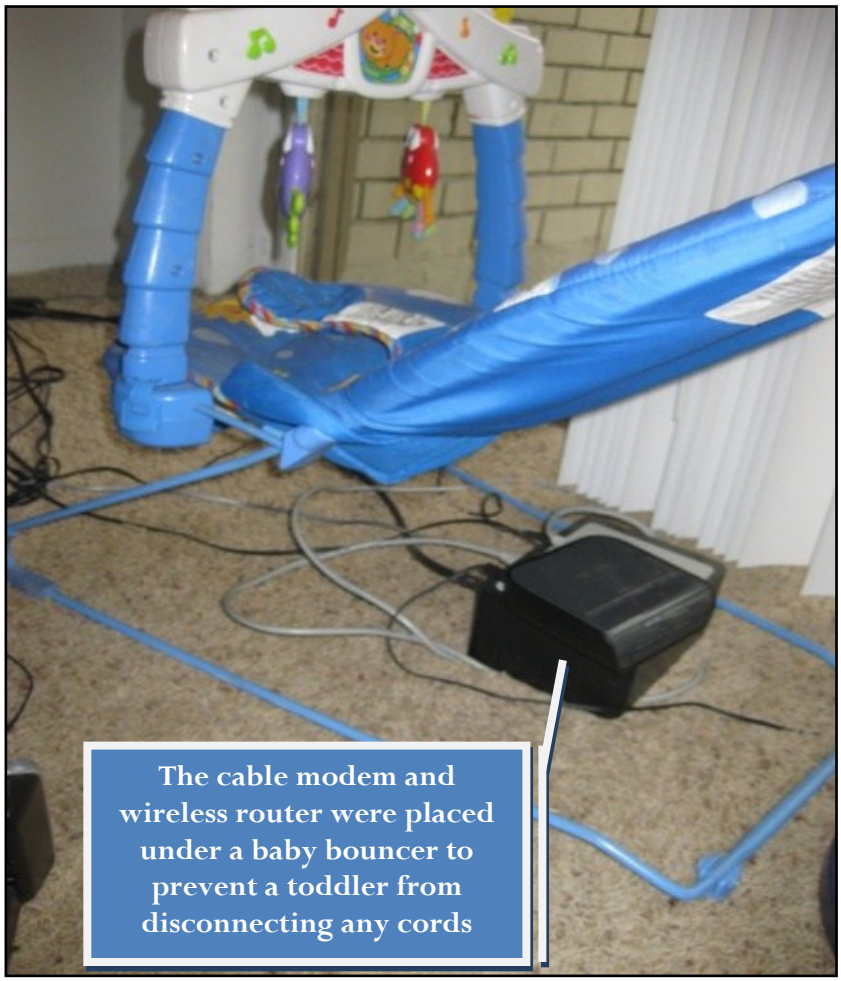


Figure 8.8: Strategies to Hide the Router from Baby

8.3. Blending of Work and Home Computing

In half of the homes, the boundaries of computing at home and computing at work faded. For Jessica Smyrna, Spencer Concord, and Viola Cascade all used computers issued by their employers in their home, and used them for leisure purposes in addition to work tasks. The occupants of the Decatur and Marietta homes ran home-based businesses from their computers, which presented a wholly different set of challenges. The implications of lax boundaries between work and home computing has been under-investigated in prior literature of home computing environments, while prior literature notes that people use computers for telecommuting, prior work ignores how

business computers used at home—as well as the presence of small businesses run from the home—impact home technical support practices.

8.3.1. **More Support is Available**

The benefits of having an employer-owned computer is that it typically also includes access to workplace helpdesk resources, which were viewed as more helpful than calling a public technical support line (e.g. Dell, Comcast, or Microsoft). For instance, Viola Cascade's company had a service where she could call for help, and using a piece of support software installed on the computer, the technician could remotely fix her computer. Jessica Smyrna, who traveled frequently for her job as a corporate continuing education specialist, also relied heavily on calling her workplace helpdesk if she had a computer problem. Both of these employers had contracts with dedicated helpdesk companies, and Viola and Jessica found these services to be extremely satisfactory and helpful. Corporate helpdesks, in contrast to customer-service lines for *all* customers of a brand, have distinct advantages. While their workloads may be just as high, they have more homogenous clientele, and likely have repeated contact with the same clientele over time. Thus, it is more possible to build a personal relationship between the technician and customer, and to know the preferences and habits of the person seeking help. Furthermore, the machines these technicians are servicing are far more likely to have standardized configurations, as well as utilities allowing for remote access by technicians.

What is also important to note is that having access to this high quality workplace helpdesk is a safety net. Jessica and Viola could both ask questions without perceiving that they were putting an undue burden on their helpers; if their preferred helpers were busy or unavailable, then they could call the helpdesk. Furthermore, for the people within home who provided help (e.g. Spencer, Keisha, and Kassandra), they experienced situations where they intentionally neglected to

help Viola or Jessica, because they knew that if they did not figure it out on their own, the women could choose to call the employer's helpdesk.

8.3.2. **(Lack of) Control Over Configurations**

The availability of workplace technical support was not all positive, though. For instance, the technicians at Spencer's company would typically re-image laptops to standard company configurations whenever problems occurred, rather than spending the time pinpointing the actual problem. Spencer found this approach to tech support frustrating, but did not have a better idea of what he could do.

The re-imaging of Spencer's machine was especially problematic during this study. On his employer-issued machine, Spencer had at some point installed network management software. When the technicians at his office re-imaged the machine several months ago, it erased the network management tool and all of its saved settings. During the course of the study, when he tried to change his network configuration or install new network-enabled devices, Spencer had to find workarounds to not having the software he previously used, and could not remember some of the settings that he had stored within the network management software.

Spencer's work laptop also illustrates another issue with the use of workplace machines in home. Since Spencer could access his workplace network via VPN from home, his employer required the use of restrictive security software. This security suite prevented many types of network-enabled software, including Tech Clips, from properly functioning. When the security suite was enabled, Spencer could not create or watch video content on Tech Clips. However, Spencer, who was very technically enthusiastic, quickly figured out that the security suite was an issue, and found a temporary workaround; he could disable it in order to see videos, though he would have to remember to turn it on and off as needed.

8.3.3. **Being Available: Special Considerations for Home Businesses**

In the Decatur and Marietta homes, the occupants relied heavily on freelance contract work to supplement their incomes. This meant they were concerned about having always-working access to email and computers in order to be in contact with existing and potential clients. In particular, for Jillian Decatur, Internet connectivity was an important aspect of her business; she used the Internet to communicate with clients and deliver finished products. The need to having working connectivity trumped desires for upgrading or making changes to the network; in fact, other occupants of the home were highly reluctant to change settings or install devices in order to prevent disruptions that could have a negative impact on Jillian's business.

8.4. **Managing the Network**

In this section, I discuss challenges that arose from having *networked computing* in the home. First, I discuss householder understandings of how to interact with infrastructure (rather than end-user facing) hardware, such as wireless routers, and how digital housekeeping practices may result in difficulties with *reconfiguration* occurring at points after initial installation. Secondly, I discuss how security mechanisms in wireless networks present challenges to technology maintenance in home settings.

8.4.1. **The Web Browser as Network Interaction Interface**

In every home except *Marietta* and *Pilot-Eileen,* wireless networks were installed prior to the study. In every case, someone *within* the home had installed the network. Despite having setup wireless networks on their own, householders showed little understanding of how to reconfigure the network (excluding Spencer, who worked as a database administrator).

What makes network reconfiguration so problematic? First, consumer-grade wireless routers typically use a web browser as a mechanism for accessing configuration details. If a person wants to reconfigure his or her router, the steps in *Figure 7.10* would need to be followed.

1. Open a web browser
2. Type in an address such as http://192.168.1.1 into the URL bar
    a. If this address does not work, try other similar addresses: 192.168.0.1, 192.168.100.1, etc.
    b. If unable to guess the address, search online for the router model
    c. Keep trying addresses suggested by the web search results
3. Once the router homepage is found, type in a username and password to access the router's configuration details (a process that possibly also requires going through several iterations of entering potential username/password combinations)

Figure 8.8.9: Steps to Access a Wireless Router Configuration Page

Using the web browser as a mechanism to interact with the wireless router is not intuitive. For instance, Jamar Lithonia, Roy Marietta, and Adrian Austell did not understand that the browser was the mechanism by which one interacts with the router. This situation was particularly problematic for Adrian, who lived in a large apartment complex. Adrian's wireless network was unsecured, and although she wanted to lock it down, she had no idea how to put security restrictions on it. Her network had severe problems with slowness and instability; it is likely that other people within her building were using her connection without her permission. During the study, she tried to put a security key on her network as one of the tasks, but could not figure out how to do so. Rather than opening up a web browser, she thought the router could be accessed through the Windows Control Panel, which is used to configure the computer's operating system.

Even if one knows that the web browser is the portal to interacting with the router, knowing which address to type can be a secondary source of problems. Manufacturers do not use a standardized address (or even better a memorable address, such as http://homewirelessrouter).

Cindy Woodstock was unable to figure out the correct address of her router's homepage; she knew she needed to type in a string of numbers into the browser toolbar, but when 192.168.1.1 did not work, she did not know what to do.

8.4.2. **Digital Housekeeping and Software for Network Management**

Standalone pieces of software for network management can offer a more familiar way of interacting with configuration mechanisms, but digital housekeeping practices within households might result in further sources of difficulty. For example, Spencer Concord, who used a laptop provided by his employer, had installed a standalone utility (likely the Linksys Easy Link Advisor) on his computer when he initially setup his network. However, in the time since the initial setup, his employer's IT group had reimaged the laptop. Spencer, who was an avid computer hobbyist, was perceptive enough to figure out how to configure his router manually, though he said that it was time consuming to remember passwords and other settings that the utility had stored for him.

More broadly, however, Spencer's experience speaks to limitations of computer software-based utilities for network management. During the course of this study, across all of the homes, householders performed a number of digital housekeeping tasks that could endanger the longevity of third-party utilities for network management. Even over a period as small as three weeks, they liberally added and removed software (including Tech Clips), for reasons such as "getting back memory" on slow computers. In some cases, they even reformatted their computers (or, in the case of Pilot-Nyree, someone else in the house chose to reformat a computer on her behalf, and did not pay attention to what pieces of software were installed).

Although software packages that are used to manage network may work quite well at initial points of installation (c.f. reports of usability trials of the Linksys Easy Link Advisor (Elmore *et al.* 2007)), will they be available in the long term, given digital housekeeping practices observed? Just

because a piece of software is installed does *not* mean that it will be there when there are needs for reconfiguration. In particular, if a third party (another householder, a friend, a workplace IT group) reimages/reformats a machine, he or she may not know or remember to reinstall aftermarket support tools.

8.4.3. **Wireless Network Security**

Security mechanisms for wireless networks caused two main types of difficulty. First, in the *Marietta* and *Decatur* homes, the householders had firewalls enabled on their wireless routers, but did not know that this capability had been enabled. When they tried to install new devices onto the network, such as the wireless photo frame and wireless printer we provided during the study, they were unable to get the devices to connect, but could not figure out why until we (the research team) cooperatively investigated their wireless router settings with the household members. Wireless router firewalls are rather silent; once they are enabled, it is easy to forget about them.

Even without firewalls, simpler authentication mechanisms for home networks, such as WEP or WPA keys, also offer a number of difficulties. In the households I studied, the person who setup the network was the only one who knew the network key—even in cases when the key was a memorable phrase such as a home phone number. Why does this matter? Not knowing the network key shuts out householders from participating in maintenance tasks; new devices cannot be added without the assistance of the person who knows the key, thus preventing some members of the household from becoming independently able to add items to the network.

Furthermore, when interacting with the wireless router's web browser interface, householders were, at times confused about the difference between the *router homepage password* and the *network key/network password;* that the two authentication mechanisms were wholly separate concepts was not always obvious.

Finally, in what best might be described as a freak anomaly, in the Marietta household, the occupants were unable to complete the installation of a wireless network-enabled photo frame provided by the research team because of a manufacturing error in the device.

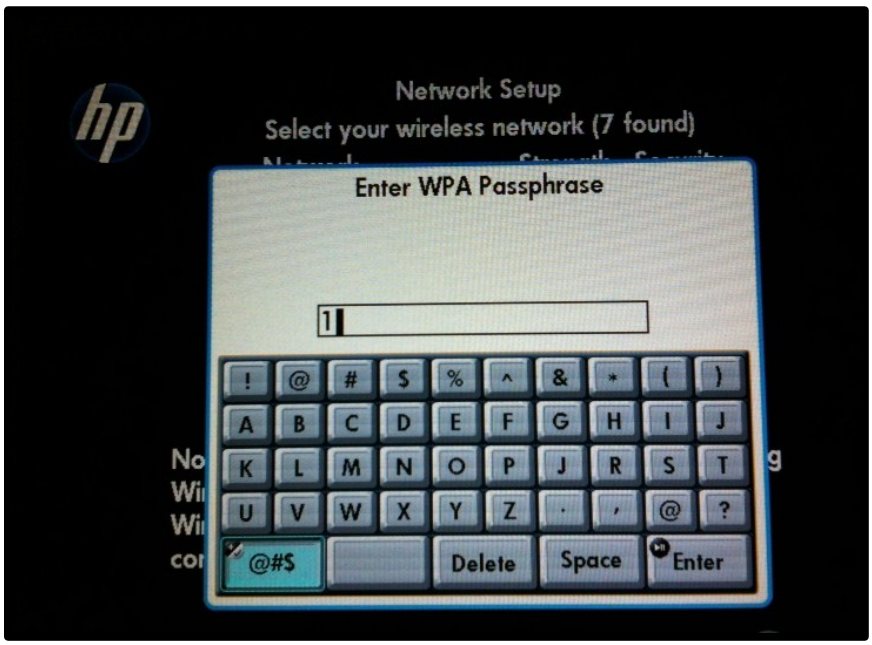


Figure 8.10: On the HP Smart WiFi Photo Frame, it is impossible to enter a network key containing the letter Q.

The photo frame used in this study (an HP Smart Wi-Fi Photo Frame) had a small problem that had apparently slipped past the manufacturer's quality control, and was present in each of the frames we used. In the screen for configuring access to the home network, the keypad was missing a letter of the alphabet. Missing from the keypad was a capital 'Q'. In place of the Q was a second instance of the letter 'J'. Without changing their network password (which the householders could not figure out how to do), the occupants of the Marietta home could not complete the setup of the photo frame.

The implication of these findings is that password-based security mechanisms lead both to confusion as well as knowledge silos that prevent egalitarian participation in home computing tasks. In the context of home settings, alternative mechanisms for authentication, such as those based on physical security rather than remembering passwords or keys (c.f. the Icebox system for exchanging router configuration mechanisms based on 'touching' a computer to a standalone configuration box (Yang and Edwards 2007) may provide more usability while maintaining a similar level of security.

8.5. **Summary**

In this chapter, I described the results of the *Family Facilitation Study,* in which ten homes participated in a three-week long study in which they interacted with new and existing information technologies in their home, as well as a customized piece of software called *Tech Clips,* which was intended for facilitating informal technical support interactions. What this study uncovered was not a one-size-fits-all solution to technical advice sharing in residential settings; instead, what emerged from my work was a rich description of how householders acquire devices, maintain and configure them over time, and seek help when problems occur. Over the chapters describing the Family Facilitation study, I explained the ways in which householders appropriated a tool intended for the provision of technical assistance in residential settings. They did not use this tool as I had expected; they instead invented new ways to use it. Furthermore, situations in which they were reluctant, struggled, or chose not to use the tool provide a more nuanced perspective on the challenges and opportunities for supporting informal technical support activities. In the remaining chapter, I discuss the broader implications of this dissertation, limitations, and opportunities for future research.

9. DISCUSSION AND CONCLUSIONS

In my dissertation research, I identified four primary sources of confusion and difficulty associated with residential computing infrastructures: (1) generativity and statefulness of home computing technologies, (2) the (relative) invisibility of home computing infrastructures, (3) the experiences and expectations of residential computing infrastructure users, and (4) the lack of coordination between stakeholders involved in the upkeep of residential computing infrastructures.

Through multiple empirical studies, I investigated the ways in which householders cope with these difficulties, including self-help, as well as requesting help from family, friends, or professional technicians. I discussed how technical help in residential settings is highly intertwined with social roles. I also discussed how steps technical experts take to maintain their presentation of self affects the quality and quantity a help-seeker may receive. Based on my initial fieldwork, I designed a technology probe called Tech Clips. This software system explored the role in which sharing of technology-related information by and for people within one's social network could play in reducing the burden of providing technical support, while simultaneously increasing the quality of support experiences. I then conducted a study in which ten families not only used the software and invited their friends to try it, but also completed a set of common computing setup and maintenance tasks. This study did not lead to a clever solution to the problems of technical advice sharing in the home, but instead provided explanations of *why* problems with technical advice sharing and home technical maintenance persist, despite the fact that help-seekers and help-givers both report dissatisfaction with the status quo of home technical support.

9.1. Lessons Learned

The deployment of the Tech Clips software in the Family Facilitation study could – at first glance – have been considered a failure. Householders did not use it much, and when they did use it, they did not like it. The software did not seem to reduce burden, nor did it facilitate the reuse of information for technical assistance in the home. In the following sections, I discuss lessons learned that apply to follow-on work.

9.1.1. Technology Probes vs. Controlled Studies

While I initially set out to understand the roles that software for giving and receiving technical assistance can help with self-efficacy, confidence, and reduction of burden, my study instead ended up being much more effective for uncovering information about the articulation work required to maintain home computing infrastructures. I chose an intervention-heavy technology probe approach to the research. Yet every choice in research design has tradeoffs; in particular, the technology probe approach made it exceedingly difficult to separate confounding variables. For instance, I cannot say, for certain, why participants experienced changes in confidence during the study. Was it due to trying out new tasks? Was it because they received reassurances from the research team that they *could* complete the tasks? What role did the software specifically play, if any? To understand the causes of confidence changes, I would recommend conducting a series of follow-up studies.

Tech Clips, while on one hand being a simple system provided a number of capabilities at once. I would suggest conducting additional studies with more stripped-down versions of the software; for instance testing versions of software that provides capability for archiving text-based messages versus video messages, anonymous messages versus attributed messages, and so on.

In evaluating these revised software artifacts, I would also rely on an A-B-A study design, in which the revised software is only used in the "B" portion of the study. This study design would help with untangling confounding variables, particularly to understand whether confidence changes are due to the software or other factors.

9.1.2. **Participant Fatigue and Study Duration**

If I were to do this study or a similar one in the future, one thing I would pay more attention to is the timing of tasks. While seven tasks split between two people is reasonable in a week, having eleven tasks per participant in the second and third weeks was, in retrospect, an unreasonable demand. This approach overwhelmed participants, especially those with the lowest self-efficacy at the start (e.g. Deedra Lithonia and Janine Dunwoody). In fact, in these two homes, the people who took the technical lead in the homes called me to discuss how their spouses could not complete tasks because there were too many and they were too difficult.

If I were to do a study such as this one again, I would do two things. First, I would reduce the number of tasks per week. Secondly, I would *increase* the duration of the study. This would allow the tasks to be spread across a longer period. Furthermore, it would assist with rapport building. The three week time span proved to be a bit short; just as families were becoming more comfortable and opening up about their experiences in ways they had not at the beginning, the study ended.

9.1.3. **Expansion of Demographics**

The homes I recruited were primarily families with children who were 10 or younger; only three of the ten homes (Pilot-Eileen, Pilot-Nyree, and Cascade) had teenagers or adult children. Furthermore, I did not make any special effort to recruit people based on their financial situations; while it became apparent during the study that disposable income (or requiring Internet access in

order to do freelance work) was vital to whether and how technologies were used, maintained, or upgraded, I did not take any special steps to recruit participants of different income brackets or income sources (e.g. freelance contract work vs. steady corporate work). Thus, I would recommend conducting a revised version of the Family Facilitation study with a more diverse set of families. That would include families with no children, with teens, with adult children, as well as families undergoing changes in structure (e.g. divorcing, having an elderly relative move in). Since financial concerns bubbled up as a factor that influences technology practices in the home, I would also suggest conducting additional studies that control for income levels of participants.

9.1.4. **Alternative Recruitment Practices**

In the Family Facilitation study, I relied on having householders recruit family and friends themselves to use the system. This approach revealed difficulties that might play out in real-world studies, for instance, help systems do not install themselves and someone will have to do the work to get help-seekers set up so that they may receive remote help.

On the other hand, this approach also left participants with little experience actually interacting with people in the Tech Clips system; few people joined or had reason to participate. An alternative method of recruitment may have been to recruit pairs of homes to be in the study, such as was the case in the Pilot study, when Nyree and Eileen were working on tasks simultaneously and connected to one another for the duration of the study. The downside of this approach is that it would not match real-world practices (rarely are people simultaneously installing the same things remotely at the same time).

At the very least, in a study future that involves recruiting remote participants, I would pay more attention to collecting log data about people who attempted to join, but quit during the installation process. Unfortunately, the web server logs for the site hosting the Tech Clips software

used a rotating schedule for log management; only the three most recent days were available for perusal. Thus, by the time I realized that people may be experiencing issues with downloading the software, the logs that might help me better understand the situation were already gone. Secondly, I would also instrument the software such that a notification would be sent to the research team in situations where someone started to install the software but quit before the installation completed.

9.1.5. **Technological Infrastructure**

Robustness of technological infrastructure was a repeated source of frustration with the Tech Clips software. For instance, the homes experienced a number of problems with recording streaming videos, either due to computer platform or network quality issues. Were I to rebuild video infrastructure for Tech Clips, I would use an alternative to the streaming video technology (red5, an open source version of Flash Media Server) that served as the backbone to Tech Clips' video recording capabilities. Additionally, in the video recording user interface, users could only do one thing: record a video clip. Participants could not edit, delete, or annotate content, thus I suspect that concerns of not being able to undo a video mistake might have deterred usage. I would recommend that future pieces of software support re-editing and alteration of content. Additionally, support for computer screen capture or inclusion of still images may also have been a useful addition.

9.2. **Looking Forward**

This dissertation revealed that given the variance of practices, confidence, and beliefs of householders surrounding technology, it remains a challenge to build systems that facilitate the provision of technical help in residential settings. Looking forward, I see several opportunities for future research in these areas under four genres: (1) support practices; (2) connecting people; (3) getting the right information; and (4) security intuition.

9.2.1. **Support Practices**

Although my study uncovered a broad swath of information about support practices in the home, many of which have not been previously reported, I see three areas in which follow-up research would be especially useful. These three areas include understanding the impact of life events on support practices, conducting more in-depth studies investigating the boundaries of work and home computing, and studying gender differences that may be present in technology support practices.

9.2.1.1. ***Life Events***

Life events such as a divorce, a child's move to college, or the loss of a job can fundamentally shift the technical support structures that people have in their lives, and the ways that people use technology at home. While my suggests that these life events alter practices, there are few technical or social mechanisms to support people with technology problems they experience during these events. Note that there is existing research investigating how people *use* technology to *communicate* during disruptive life events, little work studies how disruptive events change practices surrounding the care and maintenance of the technologies used within the private sphere of home life. Future research may examine how to account for the implications of family changes on technical assistance, as well as the design and creation of technological systems that assist with and account for common life disruptions.

9.2.1.2. ***Work vs. Home Computing***

Similarly, my study showed situations in which work computing infrastructures, and support routines used by corporate IT groups, can affect *home* computing practices. However, the data I have about this intertwining is limited; future work may follow-up with empirical studies both of additional end-users who rely on a blend of work and home computing, as well as the IT workers who support these users.

9.2.1.3. ***Gender and Support Practices***

In the post-pilot homes, four relied primarily on women as technical leads in the home, and the other four relied on males as technical leads. There appeared to be differences in how female and male leads approached computing housekeeping tasks in the home; for instance, the females in this study did not go out of their way to do "digital housekeeping" tasks for remote relatives. How, if at all, do males and females differ in their within-home and beyond-home digital housekeeping efforts? The work I have done thus far only provides a glimpse into possible gender-based differences.

9.2.2. **Connecting People**

The second genre of topics in which there are future opportunities for research are in the domain of *connecting people*. I see three possible ways to connect people who want to learn more about technology: development of new informal computing education programs involving use of software such as Tech Clips, providing scaffolding mechanisms for problem explanation, and the creation of technological systems that can connect people who are simultaneously trying to learn about computing or setup equipment.

9.2.2.1. ***Informal Computing Education***

The Tech Clips software appeared to be most successful when participants had an audience that responded to them, as well as an audience consisting of people with a similar ability level and similar interests. Could remote communication systems similar to Tech Clips be a tool used for informal computing education? For example, if we paired novices (e.g. older women who do not know much about computers) in small groups with a moderator provide a more effective or engaging way to increase computing literacy among populations that are typically written-off when it comes to learning about technology?

9.2.2.2. ***Scaffolding mechanisms for explanation of problems***

When I was conducting the pilot study, I provided additional functionality in which participants could get assistance in structuring their help requests; I developed this functionality based on questions used in reference librarianship work, which attempt to help people clarify what, exactly, they are trying to ask. However, the pilot participants did not use this functionality, so I removed it from the system. However, I do believe there is a role to understand how to help novices structure questions in ways that are more likely to elicit a response; in particular, this sort of assistance may be a way to reduce the burden of providing help, as help-seekers would be more likely to provide information in ways that are useful for the help provider. It may also be of particular use in Internet forums, in which potential responders may not have enough contextual information to help with solving a problem.

9.2.2.3. ***Chat With a Purpose: Remote Technical Help Dates***

One of the limitations of Tech Clips is that there is a mismatch in needs; those who are asking for help are not necessarily the same as those who are interested in providing help at a given point in time. Is there a role for systems that could pair people who are trying to complete the same task, e.g. to have them go on a "remote technical help date"? One could imagine a system that remotely connects people who are simultaneously trying to install a certain brand of printer, use a photo-editing program, or do something else.

9.2.3. **Getting the Right information**

The third genre of future research stemming from this work involves the *information* that people seek when looking for technical help. These opportunities include mechanisms for assessing quality of technical information online, merging content from small- and large-scale sources of knowledge,

and understanding the "intuition" that people reported using when assessing the quality and security of websites.

9.2.3.1. ***Assessment of technical information quality online***

Participants in the Family Facilitation study reported that they had trouble assessing information they viewed online about technical topics. One opportunity for future research is to understand in more detail *where* people get confused when seeking technical information online, as well as building mechanisms (e.g. browser add-ons) that can assist with scaffolding quality assessment processes.

9.2.3.2. ***Merging web-based content with locally generated knowledge***

Family and friends can be an excellent source of technical knowledge, but the Internet also provides a large amount of technical information, some that is relevant and other information that is a diversion from what an information seeker needs. Another opportunity for future research is to study how to merge the best of both worlds. How can we support people in their attempts to create and curate locally-generated content (e.g. as I had envisioned with Tech Clips), but also draw in the wisdom that can be found on Internet forums, technical help websites, or manufacturer product information that is online? For the Family Facilitation pilot study, I built a simple browser add-on for Tech Clips that would push content from websites into Tech Clips, along with an annotation that explained why they were pushing the content into the system. However, the pilot participants did not quite understand why or how to use this functionality, and experienced technical difficulties with this add-on in Internet Explorer. Thus, I removed it from the system after the pilot study; future research opportunities abound in understanding how to merge content from the web at large into small-scale systems intended to support within-household or cross-household technical assistance.

9.2.3.3. Archiving Information

I observed Tech Clips being used as a secondary communication channel coupled with telephone calls. One extension to this research is to study how to create the equivalent of a 'technical help phone call' in which telephone voice content and screen capture information could be recorded and archived in a way that it could be used for future reference. Systems such as these might allow for better archiving and reuse of information, especially when coupled with a more intuitive user interface.

9.2.4. **Security Intuition**

Finally, when completing tasks in the study, participants reported that they relied on a sense of "intuition" when deciding whether to trust downloading website content or programs off the web. While work in the usable security community *has* looked at trust issues and security indicators, there remains work to be done in understanding the nature of intuition in security decisions, as well as in how to design web-based software installers that are perceived as trustworthy.

9.3. **Conclusions**

In this dissertation, I investigated the sources of and ways that people grapple with technical complexity in the home, and built a tool to support people in their endeavors to overcome these difficulties. I examined the problem of home technology complexity not just from a technology- or usability- centered perspective, but through a socio-technical approach that addresses factors such as routines, rituals, and knowledge disparities between people who interact with residential computing infrastructures.

In summary, the contributions of this research include (1) empirical studies of how lay people understand and cope with vexing technology problems in environments lacking technical experts; (2) the development of a software systems to facilitate technical advice sharing; (3)

deployment of this system in real-world settings; and (4) recommendations for the design of future tools for facilitating technical help-giving between family and friends.

APPENDIX A: HELP AT HOME STUDY MATERIALS

Students enrolled in the spring 2008 section of CS 6455 used the following guides: User Interface Design and Evaluation at Georgia Tech. As part of a class project, they interviewed help-providers and help-seekers about informal support practices. Based on whether the person identified as primarily a help provider or help seeker, the appropriate interview guide was selected at the student's discretion.

A.1: Help Seeker Interview Guide

Use these questions as a loose guide to structure your interview. It's ok to go out of order or to ask questions that aren't on this list. You don't need to ask a particular question on the list if your interview subject answered it through a previous question. Also, if you hear something interesting that's not covered by the guide, follow up on it!

OPENING

Opening script: I'm glad you've agreed to be interviewed. My name is _____ and I am a student at GaTech. This semester, I am taking CS 6455: User Interface Design and Evaluation. As part of this class, I am learning how to interview people about their experiences with technology. Here's how this interview will work. We'll spend about 30 minutes together. During this time, I will ask you questions about your experiences getting help fixing your computer and electronics problems. I'm interested in everything you have to say about this topic, so feel free to say whatever comes to mind.

[use any of these as your grand tour question]

1. Tell me how you feel about technology.

2. What's the worst experience you've had with a broken computer at home? What did you do to solve this problem?

DIY vs. OUTSIDE HELP

1. Thinking about cars, home repair, computers—anything really. In general, do you consider yourself to be a "do-it-yourself" person or do you prefer to have others fix things for you? *[If yes, how do you decide whether a job is a DIY job or a job for someone else?]*

2. In a typical month, how often do you have computer/network problems?
    a. How often do you solve them yourself?
    b. How often do you ask others for help?

GETTING HELP FROM OTHERS

1. Tell me about the people who help you with problems with your home computer or electronics.

2. Does _____ ever help you fix your computer problems in person?

[If yes, tell me about a time when you and ____ fixed a problem together in person.]

3. Do you understand what ___ is doing when he or she fixes your computer problems?
   [Why? Why not]

4. Does _____ explain to you what he/she is doing?
   [If yes, tell me what that experience is like for you]

5. Do you care about what _____ is doing when he or she is fixing your computer problems?
   [Why? Why not?]

6. Does _____ ever help you fix your computer problems by email?

   a. If yes, tell me about a time when you and ___ fixed a problem by email.
   b. If no, why not? *[Probe to find out if they ever tried this method but it didn't work. Why didn't it work?]*

7. Does _____ ever help you fix your computer problems by IM?

   a. If yes, tell me about a time when you and ___ fixed a problem by IM.
   b. If no, why not? *[Probe to find out if they ever tried this method but it didn't work. Why didn't it work?]*

8. Does _____ ever help you fix your computer problems over the phone?

   a. If yes, tell me about a time when you and ___ fixed a problem together over the phone.
   b. If no, why not? *[Probe to find out if they ever tried this method but it didn't work. Why didn't it work?]*

SELF-HELP

1. What kinds of instructions—either verbal or on paper—does _____ give you of how to solve problems yourself?

2. Do you like reading manuals that come with electronics? If so, why? If not, why not?

3. Do you ever look for computer or electronics help online? Why/why not?

4. Do you ever call tech support lines, such as the _____ line? [use a relevant example based on the conversation so far, such as Dell tech support, Apple tech support, Comcast tech support, etc] Why/why not?

CLOSING

1. What would you do to change how computer/networking/AV/other electronic equipment works for someone like you?

2. Is there anything you thought of that you didn't get a chance to talk about?

3. Do you have any questions for me?

USEFUL PROMPTS

- Tell me more about….
- You mentioned X. Can you explain that a bit more?
- What else? Don't worry about whether it's right. Just tell me what comes to mind.
- Can you explain why ___?
- Why do you think so?
- You seemed a bit [hesitant/unsure/reluctant]. What were you thinking about?

EXTRA QUESTIONS

You might have trouble getting people to talk about their computer problems. Feel free to use the questions below at any point in the interview to spark discussion.

- What steps do you personally take to keep your computers working? Here you can ask your interviewee about virus/spyware scanning, backups, etc.

- Let me pose a problem. You are getting a lot of popup ads on the computer and your connection to the internet is really slow. What do you do about it?

- I'm wondering what you would do if you had to set up a new [DVD player|wireless router|other piece of equipment].

- Do you have wireless internet access at home? If not, why not? If so, tell me about a time when someone visited and wanted to use your wireless connection. [If needed, probe: What steps did it take to get the person online?]

A.2: Help Provider Interview Guide

Use these questions as a loose guide to structure your interview. It's ok to go out of order or to ask questions that aren't on this list. You don't need to ask a particular question on the list if your interview subject answered it through a previous question. Also, if you hear something interesting that's not covered by the guide, follow up on it!

OPENING

Opening script: I'm glad you've agreed to be interviewed. My name is _____ and I am a student at GaTech. This semester, I am taking CS 6455: User Interface Design and Evaluation. As part of this class, I am learning how to interview people about their experiences with technology. Here's how this interview will work. We'll spend about 30 minutes together. During this time, I will ask you questions about your experiences helping your friends and family with their computer and electronics problems. I'm interested in everything you have to say about this topic, so feel free to say whatever comes to mind.

[use any of these as your grand tour question]

1. Tell me about the people who you help with computer or electronics problems.

2. Tell me about a time when your family or friends asked you for help with a computer or electronics problem.

3. Discuss the worst experience you've had helping someone who had a broken computer at home.

SELF-IDENTITY/PERSONAL HISTORY

1. Tell me why people ask you for help with computer and electronics problems.

2. How did you get started helping others with their computer problems? [Probe to find out if people still find same enjoyment out of helping as when first starting, or if their attitudes toward helping their family/friends have changed over time.]

CONTACT METHODS/FREQUENCY

1. What's the typical way you get contacted to help someone with their computer/electronics problems?

2. During a typical month, how often do people ask you for help with a computer or electronics people?

3. If people do not live in the same household:
    a. How far away do you live from _____?
    b. How often do you see him/her?

c. Do you fix his/her computers or electronics on visits? *[Probe about routines—are there routines/expectations when they visit?]*

4. Do you ever take their equipment home with you to fix it on your own time? [If so, what determines whether you take things with you or fix them on site?]

5. Do you ever help _____with his/her computer/electronics problems on the phone? *[When? Why?]*

6. Do you ever help _____ with his/her computer/electronics problems by email or IM? *[When? Why?]*

SETUP/TROUBLESHOOTING

[Note: If necessary, You can repeat these questions several times to get a thorough understanding of experiences this person has had helping family and friends]

1. Tell me about the way you **set up/install** computers/electronics for _____.
   a. Is it the same as how you set up equipment for yourself? *[Why? Why not?]*

2. Do you take steps when you are setting up _____*'s* equipment to
   a. make it easier for them to fix future problems on their own? *[If yes, what are these steps?]*
   b. make sure that they won't have similar problems in the future? *[If yes, what are these steps?]*

3. Are the types of problems you have with your own computers and electronics the same as the ones that the people you help have? *[If not, why not?]*

4. Do the people you help
   a. sit with you during the setup/repair process? *[If yes, do you like or dislike this? Why?]*
   b. want to learn how to set things up on their own?
   c. show no interest in understanding what you're doing?

CLOSING

1. What would you do to change how computer/networking/AV/other electronic equipment works for someone like _____?

2. Is there anything you thought of that you didn't get a chance to talk about?

3. Do you have any questions for me?

USEFUL PROMPTS

- Tell me more about….
- You mentioned X. Can you explain that a bit more?
- Anything else? Don't worry about whether it's right. Just tell me what comes to mind.
- Can you explain why ___?
- Why do you think so?
- You seemed a bit [hesitant/unsure/reluctant]. What were you thinking about?

EXTRA QUESTIONS

You might have trouble getting people to talk about their computer problems. Feel free to use the questions below at any point in the interview to spark discussion.

- What steps do you personally take to keep your computers working? Here you can ask your interviewee about virus/spyware scanning, backups, etc.

- Let me pose a problem. You are getting a lot of popup ads on the computer and your connection to the internet is really slow. What do you do about it?

- I'm wondering what you would do if you had to set up a new [DVD player|wireless router|other piece of equipment].

- Do you have wireless internet access at home? If not, why not? If so, tell me about a time when someone visited and wanted to use your wireless connection. [If needed, probe: What steps did it take to get the person online?]

APPENDIX B: FAMILY FACILITATION STUDY MATERIALS

B.1: Home Tour Interview Guide

Home tours were conducted at the beginning of the *Family Facilitation Study*. These tours aimed to (1) identify current practices of technology setup, use, and maintenance in the household; and to (2) identify technologies already in the home. The interview guide used for the home tour is as follows:

- Introduce self and study. Explain and complete consent/assent forms. Provide contact information via a business card and reassure participants to contact the research team at any time if they have any questions, concerns, or problems.

- Administer survey asking about demographic information, attitudes toward technology, and attitudes toward asking for or giving help

- Ask householders to independently create a sketch of their home network

- Next, I will probe about helping practices by having them complete an exercise in which they identify the 5 to whom they are most likely provide help to and ask for help.

- The home network sketch and list of those involved with helping practices should then be used to launch an interview. Probe for details about their choices with questions such as:
    - *Tell me about this person.*
    - *How did you meet this person?*
    - *Tell me about the most recent time you asked/were asked by this person for help*
    - *What kinds of technical advice is this person best/worst for?*
    - *Could you walk me through the sketch you created?*

- I will ask the household members to take me on a "home technology tour" in which they show me which technologies they have, and discuss their experiences with them. During this tour I will probe about existing technology use and help seeking practices, making sure to get the perspective of each person in the house. Questions may include:
    - *Where did they get purchasing advice?*
    - *Why did they buy this item?*
    - *Who set this item up?*
    - *Who maintains it?*
    - *Have they experienced problems with it? Where do they turn for help?*
    - *If they want to learn more about how to use this item, where do they turn for help?*

- The pre-study activities conclude with installing Tech Clips, having the household members try it out, and leaving them with a box of "technology challenges" for week 1.

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When I have technical problems at home, I personally contact these companies/people to get help:

	Nearly all the time	Most of the time	Sometimes	Rarely	Never
I call a technical help or customer service telephone line					
I visit the Apple Genius Bar or another in-store repair service					
A technical help company visits my house (e.g. Geeksquad)					
I ask a person who lives in my house					
I ask a family member who doesn't live with me					
I ask a friend					
I ask a neighbor					
I ask someone at work					
I browse Internet forums or mailing lists					
I just figure things out on my own					
I get help in some other way not listed					

1

PRESTUDY: H __ P__

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This chart lists activities that people like you might do with technology. FOR EACH ACTIVITY, PLACE AN "X" IN THE BOX DESCRIBING HOW CONFIDENT YOU ARE ABOUT DOING THIS ACTIVITY

	Very unconfident	A little unconfident	Neither confident nor unconfident	A little confident	Very confident
Using email					
Using a digital camera					
Using image editing programs (e.g. Photoshop, Illustrator, Paint)					
Telling if information on a website should be trusted					
Figuring out what's wrong when the Internet doesn't work or is slow					
Setting up a new printer					
Setting up a home network					
Understanding terms/words relating to computer software					
Understanding terms/words relating to computer hardware					
Programming a computer					
Playing games on the computer					
Watching videos online					
Playing MP3s or other music files					
Recording a video file					
Changing information on a wiki (e.g. Wikipedia)					
Chatting over the internet (e.g. using AIM, Google Talk, MSN)					
Using social networking (e.g. Facebook, MySpace, LinkedIn)					
Purchasing home electronics					
Making web pages					
Knowing what kinds of computers and electronics are best					
Explaining how computers work					
Sharing files with my family and friends					
Understanding the technical aspects of computers					
Undoing a mistake I've made with a computer					
Using a smart phone (e.g. Blackberry, iPhone, Android)					
Protecting myself from computer viruses					
Teaching my family and friends how to use technologies					

PRESTUDY: H __ P__

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Imagine you have a technical problem. Who are five people who would most likely help if you had a technical problem?

1. _____

2. _____

3. _____

4. _____

5. _____

Imagine someone you know has a technical problem. Who are five people who *you* would be most likely to help if they had a technical problem?

1. _____

2. _____

3. _____

4. _____

5. _____

PRESTUDY: H __ P__

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These sentences in the chart below talk about your opinions about helping other people. There are no right or wrong answers, so please answer in the way that best describes you.

FOR EACH SENTENCE, PLACE AN "X" IN THE BOX THAT DESCRIBES YOUR OPINION BEST.

	Agree a lot	Agree a little	Neither agree nor disagree	Disagree a little	Disagree a lot
It bothers me when other people neglect my needs.					
When making a decision, I take other people's needs and feelings into account.					
I'm not especially sensitive to other people's feelings.					
I don't consider myself to be a particularly helpful person.					
I believe people should go out of their way to be helpful.					
I don't especially enjoy giving others aid.					
I expect people I know to be responsive to my needs and feelings.					
I often go out of my way to help another person.					
I believe it's best not to get involved taking care of other people's personal needs.					
I'm not the sort of person who often comes to the aid of others.					
When I have a need, I turn to others I know for help.					
When people get emotionally upset, I tend to avoid them.					
People should keep their troubles to themselves.					
When I have a need that others ignore, I'm hurt.					

PRESTUDY: H __ P__

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Your approximate age:

- ☐ Under 18
- ☐ 18-22
- ☐ 23-30
- ☐ 31-40
- ☐ 41-50
- ☐ 51-60
- ☐ 61-70
- ☐ Over 70

Your gender*:*

- ☐ Female
- ☐ Male

Do you consider yourself:

- ☐ Technically or mechanically inclined (*e.g. you have hobbies like woodworking, fixing things at home, reading magazines like Popular Mechanics, etc*)
- ☐ Not technically or mechanically inclined

Is using or learning about technology one of your hobbies?

- ☐ Yes
- ☐ No

PRESTUDY: H __ P__

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When it comes to buying computers or electronics for our home, I make decisions about what we should buy

- ☐ Nearly all of the time
- ☐ About 75% of the time
- ☐ About 50% of the time
- ☐ About 25% of the time
- ☐ Rarely or never

Highest level of education

- ☐ Some high school
- ☐ Completed high school
- ☐ Some college or trade school
- ☐ Completed undergraduate college
- ☐ Graduate school

Did your education involve significant technical or scientific training?

- ☐ Yes
- ☐ No

How would you describe your career/job?

_____

_____

_____

PRESTUDY: H __ P__

Georgia Tech College of Computing

Home Computer Network Sketch

Please use this piece of paper to draw the components and their connections that make up your home computer network. (Please feel free to use boxes and lines to represent to components, labeling each one).

PRESTUDY: H __ P__

Georgia Tech | College of Computing

This chart asks about much experience you have using technologies.

Prior to being in this study, how <u>enthusiastic</u> were you about doing the following things?

	No experience	A little experience	Some experience	A lot of experience
Using email				
Using a digital camera				
Using image editing programs (e.g. Photoshop, Illustrator, Paint)				
Telling if information on a website should be trusted				
Figuring out what's wrong when the Internet doesn't work or is slow				
Setting up a new printer				
Setting up a home network				
Understanding terms/words relating to computer software				
Understanding terms/words relating to computer hardware				
Programming a computer				
Playing games on the computer				
Watching videos online				
Playing MP3s or other music files				
Recording a video file				
Changing information on a wiki (e.g. Wikipedia)				
Chatting over the internet (e.g. using AIM, Google Talk, MSN)				
Using social networking (e.g. Facebook, MySpace, LinkedIn)				
Purchasing home electronics				
Making web pages				
Knowing what kinds of computers and electronics are best				
Explaining how computers work				
Sharing files with my family and friends				
Understanding the technical aspects of computers				
Undoing a mistake I've made with a computer				
Using a smart phone (e.g. Blackberry, iPhone, Android)				
Protecting myself from computer viruses				
Teaching my family and friends how to use technologies				

PRESTUDY: H __ P__

Georgia Tech College of Computing

PAGE 2: This second chart asks about how enthusiastic you are about using technology. Prior to being in this study, how enthusiastic were you about doing the following things?

	Not at all enthusiastic	A little enthusiastic	Somewhat enthusiastic	Very enthusiastic
Using email				
Using a digital camera				
Using image editing programs (e.g. Photoshop, Illustrator, Paint)				
Telling if information on a website should be trusted				
Figuring out what's wrong when the Internet doesn't work or is slow				
Setting up a new printer				
Setting up a home network				
Understanding terms/words relating to computer software				
Understanding terms/words relating to computer hardware				
Programming a computer				
Playing games on the computer				
Watching videos online				
Playing MP3s or other music files				
Recording a video file				
Changing information on a wiki (e.g. Wikipedia)				
Chatting over the internet (e.g. using AIM, Google Talk, MSN)				
Using social networking (e.g. Facebook, MySpace, LinkedIn)				
Purchasing home electronics				
Making web pages				
Knowing what kinds of computers and electronics are best				
Explaining how computers work				
Sharing files with my family and friends				
Understanding the technical aspects of computers				
Undoing a mistake I've made with a computer				
Using a smart phone (e.g. Blackberry, iPhone, Android)				
Protecting myself from computer viruses				
Teaching my family and friends how to use technologies				

PRESTUDY: H __ P__

B.3: Post-Survey

Georgia Tech College of Computing

TECHNOLOGY INVENTORY PART 2

	Disagree Strongly	Disagree Somewhat	Agree Somewhat	Agree Strongly
When using a computer, people can pretty much accomplish whatever they set out to accomplish				
Getting technology to work is mostly a matter of luck				
Most people are capable of being good with computers if they make an effort				
When it comes to getting your computer to work well, who you know is more important than what you know				
You have to be a genius to be good at using computers				
It takes a lot of luck to be outstanding with computers				
I could probably do just about anything I need to with computers				
I feel I need an experienced person nearby when I use the computer				
I can make the computer do what I want it to do				
I will probably never be able to use computers effectively				
If I had a problem using a computer, I could probably solve it one way or another				
I would never use computers if someone wasn't pushing me to do so				
When something goes wrong with the computer, I feel there would be little I could do about it				

1

PostSTUDY: H __ P__

TECHNOLOGY INVENTORY PART 2

Imagine you have a technical problem. Who are the five people who would most likely help if you had a technical problem?

1. _____

2. _____

3. _____

4. _____

5. _____

Imagine someone you know has a technical problem. Who are the five people who *you* would be most likely to help if they had a technical problem?

1. _____

2. _____

3. _____

4. _____

5. _____

PostSTUDY: H __ P__

Georgia Tech College of Computing

TECHNOLOGY INVENTORY PART 2

1. **This chart lists activities that people like you might do with technology. FOR EACH ACTIVITY, PLACE AN "X" IN THE BOX THAT DESCRIBES HOW CONFIDENT YOU ARE ABOUT DOING THIS ACTIVITY**

	Very unconfident	A little unconfident	Neither confident nor unconfident	A little confident	Very confident
Using email					
Using a digital camera					
Using image editing programs (e.g. Photoshop, Illustrator, Paint)					
Telling if information on a website should be trusted					
Figuring out what's wrong when the Internet doesn't work or is slow					
Setting up a new printer					
Setting up a home network					
Understanding terms/words relating to computer software					
Understanding terms/words relating to computer hardware					
Programming a computer					
Playing games on the computer					
Watching videos online					
Playing MP3s or other music files					
Recording a video file					
Changing information on a wiki (e.g. Wikipedia)					
Chatting over the internet (e.g. using AIM, Google Talk, MSN)					
Using social networking (e.g. Facebook, MySpace, LinkedIn)					
Purchasing home electronics					
Making web pages					
Knowing what kinds of computers and electronics are best					
Explaining how computers work					
Sharing files with my family and friends					
Understanding the technical aspects of computers					
Undoing a mistake I've made with a computer					
Using a smart phone (e.g. Blackberry, iPhone, Android)					
Protecting myself from computer viruses					
Teaching my family and friends how to use technologies					

PostSTUDY: H __ P__

Georgia Tech College of Computing

TECHNOLOGY INVENTORY PART 2

How often did you browse Tech Clips?

☐ several times a day
☐ once a day
☐ every couple of days
☐ weekly
☐ monthly
☐ only when I have a technical problem
☐ only when I had a pop-up message on my computer
☐ never

Why did you browse Tech Clips? ***(check all that apply)***

☐ to learn from messages in it
☐ to find posted questions I wanted to answer
☐ because it's fun
☐ because I had a pop-up message on my computer
☐ to take a break from other work
☐ because I'm curious to see what's in it
☐ to find out more about what my family and friends are up to
☐ Other (please describe):

_____

_____

_____

PostSTUDY: H __ P__

Georgia Tech College of Computing

TECHNOLOGY INVENTORY PART 2

There were probably some times you didn't use Tech Clips. Please check the boxes that match reasons you didn't use Tech Clips at times. ***Remember, there are NO right or wrong answers. We're interested in everything you have to say!***

- ☐ Nothing to say
- ☐ Not ready to post yet
- ☐ Don't write very well
- ☐ Didn't know how to phrase the question
- ☐ Don't like how I sound on video
- ☐ Don't like how I look on video
- ☐ Got what I needed without posting
- ☐ Felt shy
- ☐ Thought it was helpful to not post
- ☐ Was being a good listener
- ☐ Only speak if I have something worthwhile to say
- ☐ Don't want to pretend to be an expert if I'm not
- ☐ Couldn't figure out the software
- ☐ Didn't have time
- ☐ It was easier to use another method (e.g. calling on the phone or talking in person)
- ☐ My computer's too old so the software doesn't work well
- ☐ Didn't fit in with the group using it
- ☐ Not really interested
- ☐ Not enough interesting content
- ☐ Didn't think I'd get an answer
- ☐ Takes too long to get an answer
- ☐ Responses might make me feel dumb or bad about myself

PostSTUDY: H __ P__

Georgia Tech College of Computing

TECHNOLOGY INVENTORY PART 2

- ☐ Responses are mean, rude, or unpleasant
- ☐ Might post something stupid
- ☐ Didn't think I'd get a good answer
- ☐ Other people don't know enough to be able to help me with the problems I have
- ☐ Not enough people using it
- ☐ Some other reasons (explain):

_____

_____

_____

_____

_____

_____

_____

_____

PostSTUDY: H __ P__

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TECHNOLOGY INVENTORY PART 2

Home Computer Network Sketch

Please use this piece of paper to draw the components and their connections that make up your home computer network. (Please feel free to use boxes and lines to represent to components, labeling each one).

PostSTUDY: H __ P__

TECHNOLOGY INVENTORY PART 2

Georgia Tech College of Computing

Please list the people living in your home

Name	Age	Which computers does this person use?	For what activities does this person use computers?	Is this person enthusiastic about computers?	Is this person good with computers?
				Yes / No	Yes / No
				Yes / No	Yes / No
				Yes / No	Yes / No
				Yes / No	Yes / No
				Yes / No	Yes / No
				Yes / No	Yes / No
				Yes / No	Yes / No

PostSTUDY: H __ P__

TECHNOLOGY INVENTORY PART 2

Georgia Tech | College of Computing

Please list people who do *not* live in your home, but use computers while visiting you

Name	Age	Which computers does this person use?	How often does this person visit?	For what activities does this person use computers?	Is this person enthusiastic about computers?	Is this person good with computers?
					Yes / No	Yes / No
					Yes / No	Yes / No
					Yes / No	Yes / No
					Yes / No	Yes / No
					Yes / No	Yes / No
					Yes / No	Yes / No
					Yes / No	Yes / No

PostSTUDY: H __ P__

TECHNOLOGY INVENTORY PART 2

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1. **Now that you've been in this study, how much <u>experience</u> do you have doing these things?**

	No experience	A little experience	Some experience	A lot of experience
Using email				
Using a digital camera				
Using image editing programs (e.g. Photoshop, Illustrator, Paint)				
Telling if information on a website should be trusted				
Figuring out what's wrong when the Internet doesn't work or is slow				
Setting up a new printer				
Setting up a home network				
Understanding terms/words relating to computer software				
Understanding terms/words relating to computer hardware				
Programming a computer				
Playing games on the computer				
Watching videos online				
Playing MP3s or other music files				
Recording a video file				
Changing information on a wiki (e.g. Wikipedia)				
Chatting over the internet (e.g. using AIM, Google Talk, MSN)				
Using social networking (e.g. Facebook, MySpace, LinkedIn)				
Purchasing home electronics				
Making web pages				
Knowing what kinds of computers and electronics are best				
Explaining how computers work				
Sharing files with my family and friends				
Understanding the technical aspects of computers				
Undoing a mistake I've made with a computer				
Using a smart phone (e.g. Blackberry, iPhone, Android)				
Protecting myself from computer viruses				
Teaching my family and friends how to use technologies				

Georgia Tech | College of Computing

TECHNOLOGY INVENTORY PART 2

1. **Now that you've finished this study, how <u>enthusiastic</u> are you about doing these things?**

	Not at all enthusiastic	A little enthusiastic	Somewhat enthusiastic	Very enthusiastic
Using email				
Using a digital camera				
Using image editing programs (e.g. Photoshop, Illustrator, Paint)				
Telling if information on a website should be trusted				
Figuring out what's wrong when the Internet doesn't work or is slow				
Setting up a new printer				
Setting up a home network				
Understanding terms/words relating to computer software				
Understanding terms/words relating to computer hardware				
Programming a computer				
Playing games on the computer				
Watching videos online				
Playing MP3s or other music files				
Recording a video file				
Changing information on a wiki (e.g. Wikipedia)				
Chatting over the internet (e.g. using AIM, Google Talk, MSN)				
Using social networking (e.g. Facebook, MySpace, LinkedIn)				
Purchasing home electronics				
Making web pages				
Knowing what kinds of computers and electronics are best				
Explaining how computers work				
Sharing files with my family and friends				
Understanding the technical aspects of computers				
Undoing a mistake I've made with a computer				
Using a smart phone (e.g. Blackberry, iPhone, Android)				
Protecting myself from computer viruses				
Teaching my family and friends how to use technologies				

B.4: Example of Task Logging Form

IMPORTANT: ORE YOU BEGIN
THIS TASI EASE ANSWER
THESE QUESTIONS

1. I expect this task to be:

___ Very easy
___ Somewhat easy
___ Neither easy nor difficult
___ Somewhat difficult
___ Very difficult

2. When it comes to this task, I **now:**

___ A lot about how to do this ta
___ A little about how to do this
___ Nothing about how to do thi

TASK DESCRIPTION GOES

When you are done attempting this task (<u>EVEN IF YOU DID NOT FINISH IT</u>) please fill out the following short survey so we can better understand your experience. Thank you for your help with this study!

1. How difficult was the task?

____ Very easy
____ Somewhat easy
____ Neither easy nor difficult
____ Somewhat difficult
____ Very difficult

2. This task took:

____ More time than I expected
____ About the same amount of time that I expected
____ Less time than I expected

3. How, if at all, did you seek help with this task? (CHECK ALL THAT APPLY)

____ Called someone
____ Someone came over to help me
____ Emailed someone
____ Posted to an online forum
____ Looked at (but did not post to) an online forum
____ Used a search engine (e.g. Google, Yahoo)
____ Used Tech Clips
____ Used an instant messaging program (e.g. AIM, Google Talk, MSN)
____ Did something else (explain _____)

Name	Task	Date

Mental Demand — How mentally demanding was the task?

Very Low — Very High

Physical Demand — How physically demanding was the task?

Very Low — Very High

Temporal Demand — How hurried or rushed was the pace of the task?

Very Low — Very High

Performance — How successful were you in accomplishing what you were asked to do?

Perfect — Failure

Effort — How hard did you have to work to accomplish your level of performance?

Very Low — Very High

Frustration — How insecure, discouraged, irritated, stressed, and annoyed wereyou?

Very Low — Very High

4. What steps did you try to complete this task?

5. What else would you like us to know about your experience with this task?

B.5: Online Survey to Remote Participants

This survey was administered to all people who were invited by their friends and family to try Tech Clips, and subsequently installed it. Of the 10 people who installed the software, this survey netted a mere 2 responses

.

GT Technology Study Survey

A few weeks ago, you helped out a friend or family member who was in a Georgia Tech research study by installing a program called Tech Clips on your computer.

We've reached the end of the study, and have a short survey (approximately 5-10 minutes to complete) for you to fill out. Your feedback is really helpful—even if you downloaded the software then took it off your computer immediately. To complete the survey, you can follow the link below. If you have trouble opening the survey link, please contact _____.

In appreciation for your participation, upon completion of this survey, we'll email you a $15 Amazon.com gift card.

Thanks!

Erika (on behalf of the Georgia Tech Research Team)

---

* Required

Who asked you to install the Tech Clips software? * [ ]

The person who asked me to install Tech Clips is: *

- ○ A family member
- ○ A friend
- ○ A coworker
- ○ A neighbor
- ○ Other: [ ]

Why did you decide to install Tech Clips? (CHECK ALL THAT APPLY) *

- ☐ Felt obligated to help the person who asked me
- ☐ Curious what it was all about
- ☐ Wanted the $15 gift card
- ☐ Wanted to share videos with other people
- ☐ Wanted to share websites with other people

- ☐ Wanted to stay in contact with my friends/family
- ☐ Other: _____

Which best describes how much you used Tech Clips? *

- ○ I immediately uninstalled it
- ○ I left it installed but forgot about using it
- ○ I used it once or twice
- ○ I used it every so often
- ○ I used it almost every day
- ○ Other: _____

Why did you decide to stop using Tech Clips? (CHECK ALL THAT APPLY)

- ☐ Nothing to say
- ☐ Don't write very well
- ☐ Don't like how I sound on video
- ☐ Don't like how I look on video
- ☐ Got what I needed without posting
- ☐ Felt shy
- ☐ Thought it was being helpful not to post
- ☐ Was being a good listener
- ☐ Concerned I might get a virus from the software
- ☐ Only speak if I have something worthwhile to say
- ☐ Don't want to pretend to be an expert if I'm not
- ☐ Couldn't figure out the software
- ☐ Didn't have time
- ☐ It was easier to use another method (e.g. calling on the phone or emailing)
- ☐ My computer's too old
- ☐ The software didn't work well
- ☐ Didn't fit in with the group using it
- ☐ Not really interested

- ☐ Not enough interesting content
- ☐ Didn't think I'd get an answer
- ☐ Takes too long to get an answer
- ☐ Responses might make me feel dumb or bad about myself
- ☐ Responses are mean, rude, or unpleasant
- ☐ Might post something stupid
- ☐ Didn't think I'd get a good answer
- ☐ Not enough people using it
- ☐ Other: _____

When you're at HOME, how often do you use the computer? *

- ○ More than an hour a day
- ○ 1 hour or less a day
- ○ A few times a week
- ○ Once a week or less

When you're at WORK, how often do you use the computer? *

- ○ I don't work
- ○ More than an hour a day
- ○ 1 hour or less a day
- ○ A few times a week
- ○ Once a week or less

If you had any problems with the Tech Clips software, please describe them in the space below

Do you own a webcam? *

- ○ Yes
- ○ No

- Unsure

Do you own a computer with a video camera built in? *

- Yes
- No

What is your approximate age? *

- Under 18
- 18-22
- 23-30
- 31-40
- 41-50
- 51-60
- 61-70
- Over 70

Is using or learning about technology one of your hobbies? *

- Yes
- No

Did your education include significant technical training? *

- Yes
- No

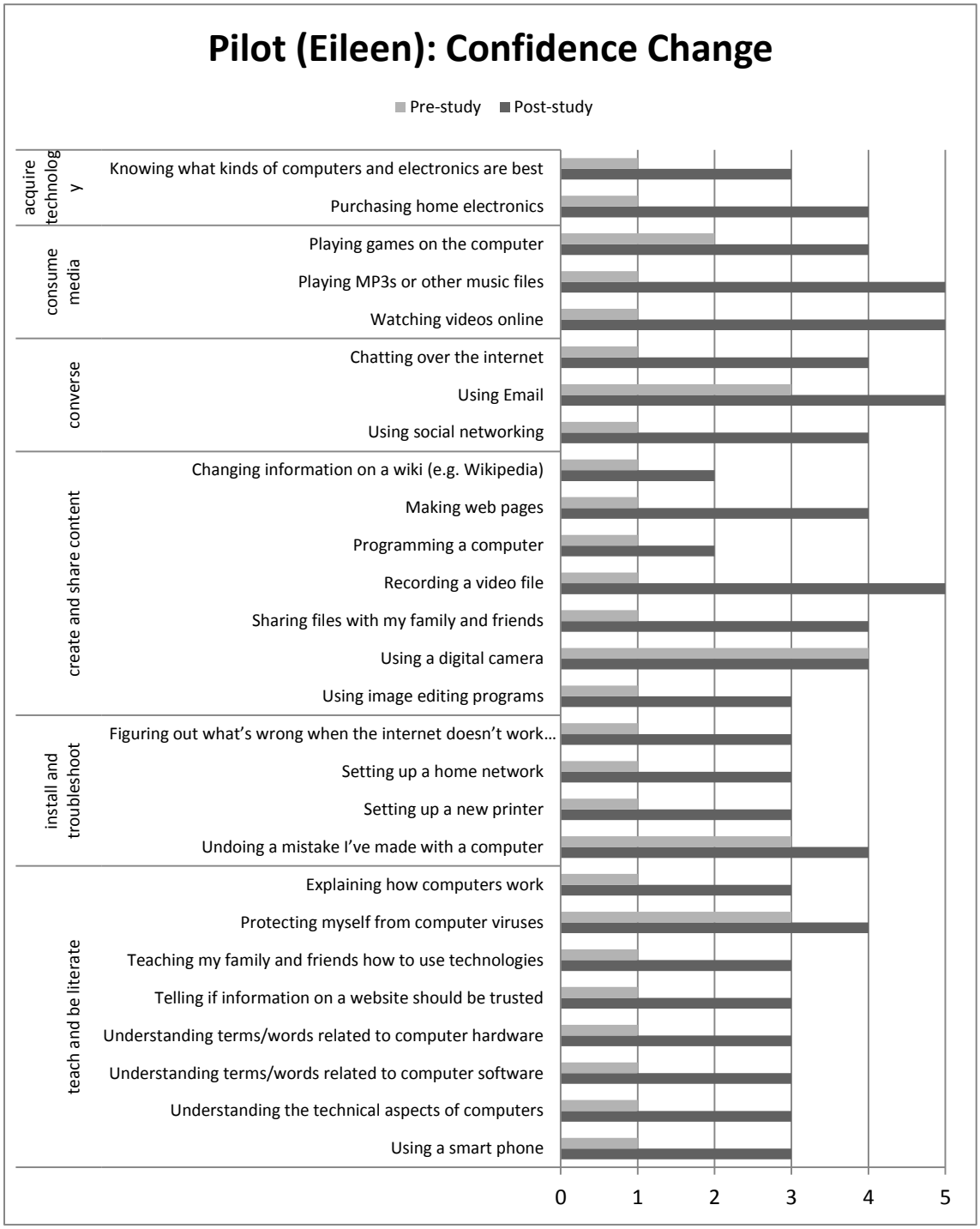
What is your profession?

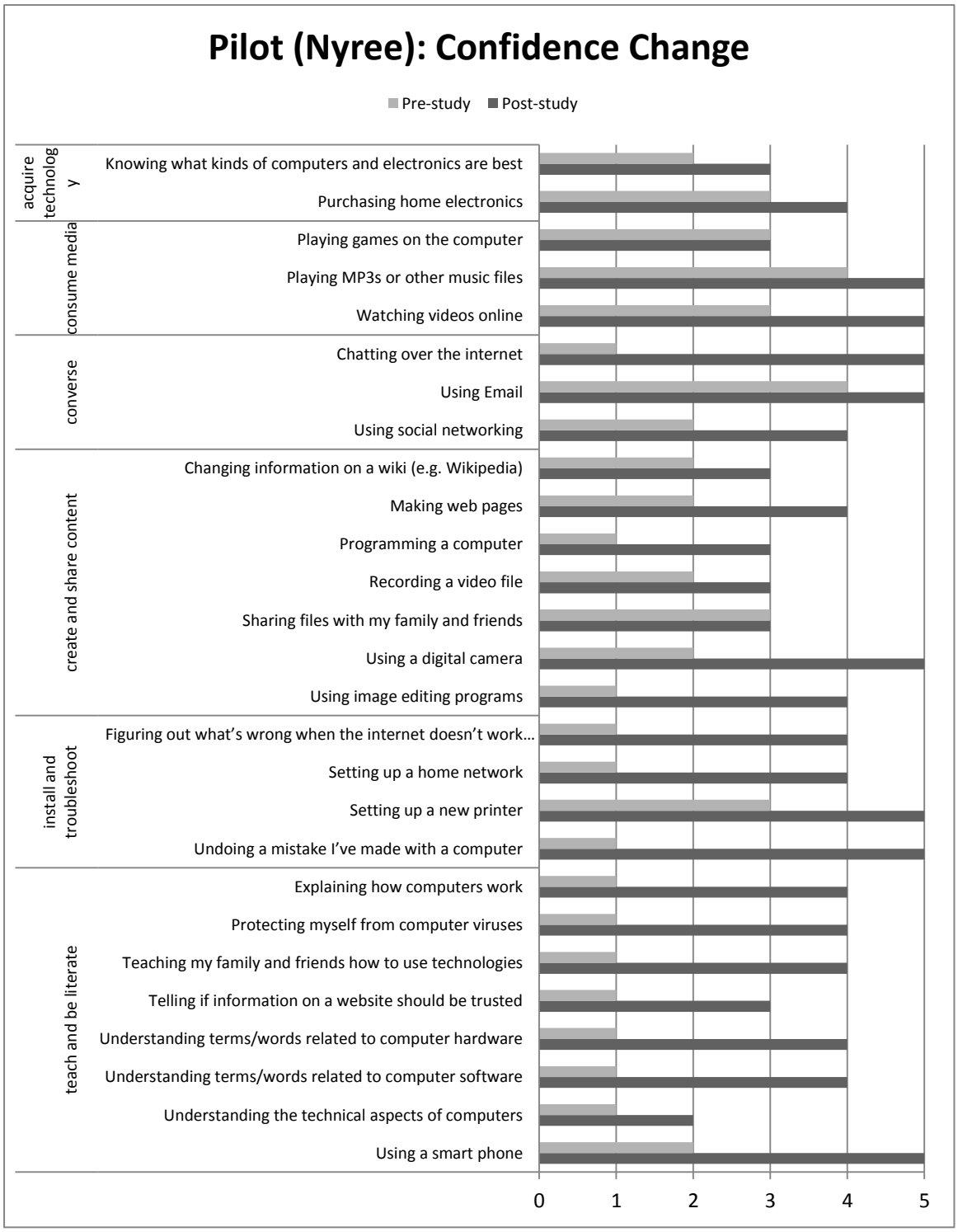
What is your email address? (We need this so we can send you the $15 Amazon.com giftcard)

What else would you like the research team to know? We're interested in everything you have to say.

APPENDIX C: Pre-Post Confidence Change Data

C.1: Pilot




Pilot (Nyree): Confidence Change
Pre-study
Post-study
acquire technology
Knowing what kinds of computers and electronics are best
Purchasing home electronics
consume media
Playing games on the computer
Playing MP3s or other music files
Watching videos online
converse
Chatting over the internet
Using Email
Using social networking
create and share content
Changing information on a wiki (e.g. Wikipedia)
Making web pages
Programming a computer
Recording a video file
Sharing files with my family and friends
Using a digital camera
Using image editing programs
install and troubleshoot
Figuring out what's wrong when the internet doesn't work...
Setting up a home network
Setting up a new printer
Undoing a mistake I've made with a computer
teach and be literate
Explaining how computers work
Protecting myself from computer viruses
Teaching my family and friends how to use technologies
Telling if information on a website should be trusted
Understanding terms/words related to computer hardware
Understanding terms/words related to computer software
Understanding the technical aspects of computers
Using a smart phone
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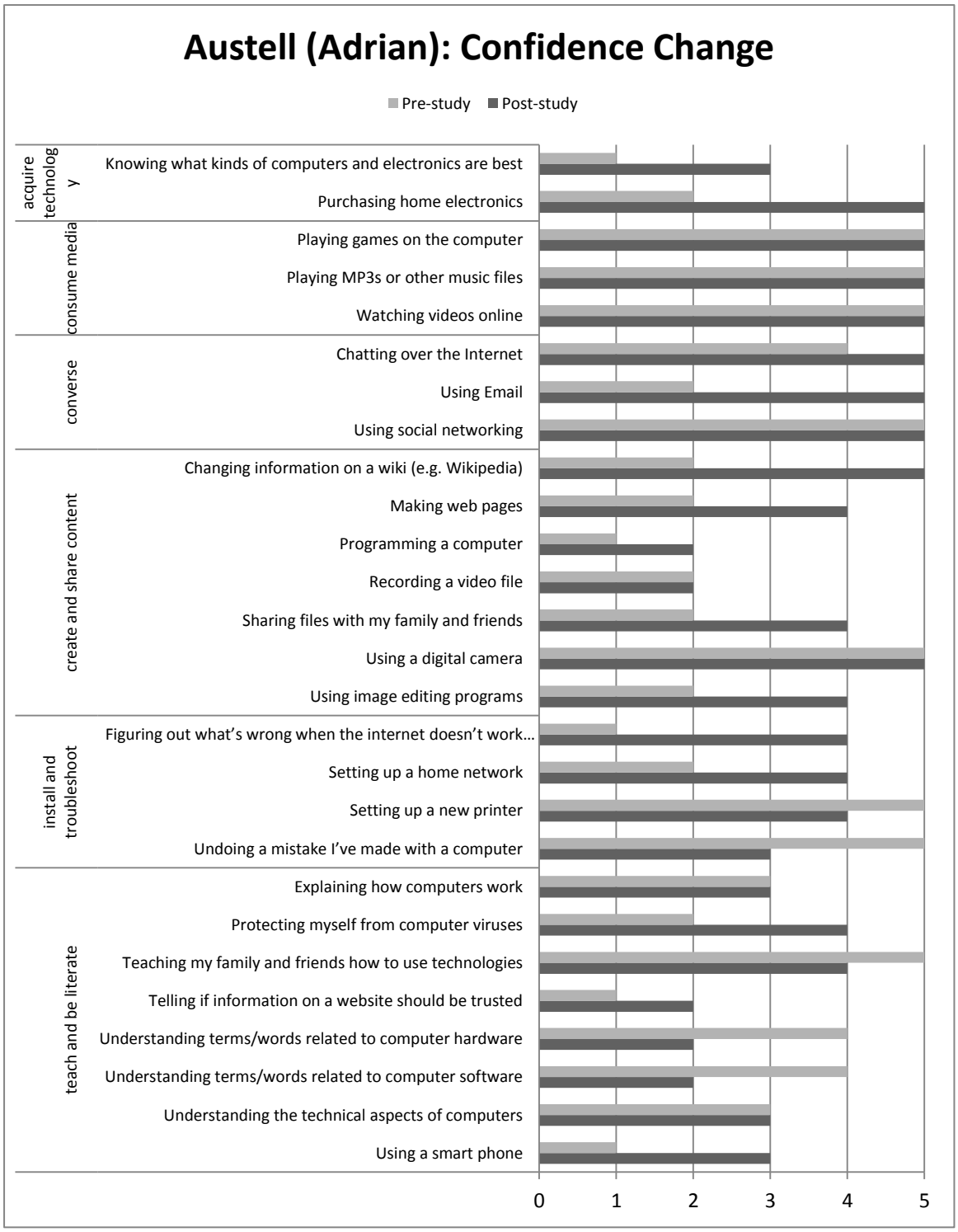
C.2: Austell


Austell (Adrian): Confidence Change
Pre-study
Post-study
acquire technology
Knowing what kinds of computers and electronics are best
Purchasing home electronics
consume media
Playing games on the computer
Playing MP3s or other music files
Watching videos online
converse
Chatting over the Internet
Using Email
Using social networking
create and share content
Changing information on a wiki (e.g. Wikipedia)
Making web pages
Programming a computer
Recording a video file
Sharing files with my family and friends
Using a digital camera
Using image editing programs
install and troubleshoot
Figuring out what's wrong when the internet doesn't work...
Setting up a home network
Setting up a new printer
Undoing a mistake I've made with a computer
teach and be literate
Explaining how computers work
Protecting myself from computer viruses
Teaching my family and friends how to use technologies
Telling if information on a website should be trusted
Understanding terms/words related to computer hardware
Understanding terms/words related to computer software
Understanding the technical aspects of computers
Using a smart phone
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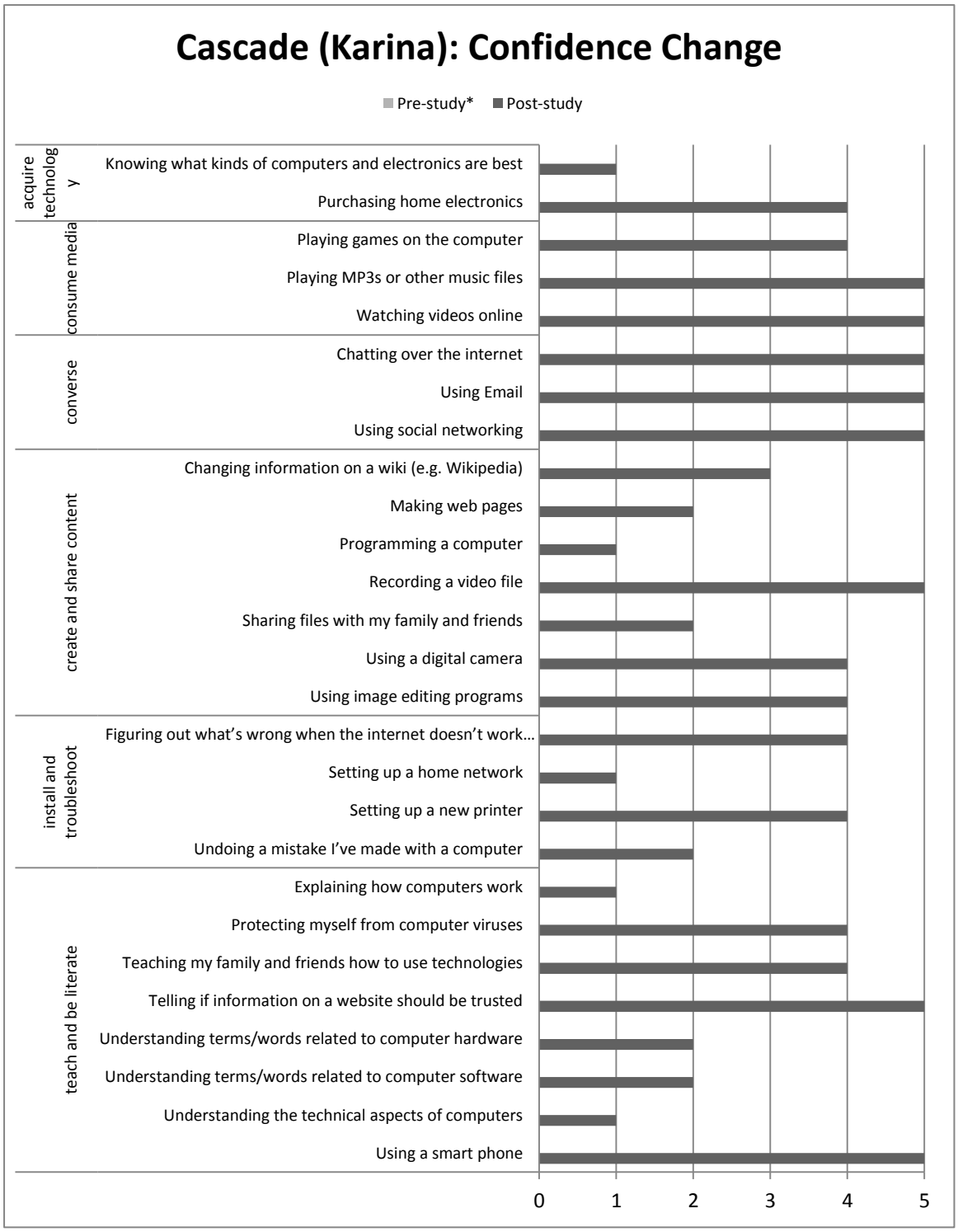
C.3: Cascade

**** note that Karina joined the study late, as she was still away at college when her household***



began. Hence I could only collect post-study data from her.


Cascade (Kassandra): Confidence Change
Pre-study
Post-study
acquire technology
Knowing what kinds of computers and electronics are best
Purchasing home electronics
consume media
Playing games on the computer
Playing MP3s or other music files
Watching videos online
converse
Chatting over the internet
Using Email
Using social networking
create and share content
Changing information on a wiki (e.g. Wikipedia)
Making web pages
Programming a computer
Recording a video file
Sharing files with my family and friends
Using a digital camera
Using image editing programs
install and troubleshoot
Figuring out what's wrong when the internet doesn't work...
Setting up a home network
Setting up a new printer
Undoing a mistake I've made with a computer
teach and be literate
Explaining how computers work
Protecting myself from computer viruses
Teaching my family and friends how to use technologies
Telling if information on a website should be trusted
Understanding terms/words related to computer hardware
Understanding terms/words related to computer software
Understanding the technical aspects of computers
Using a smart phone
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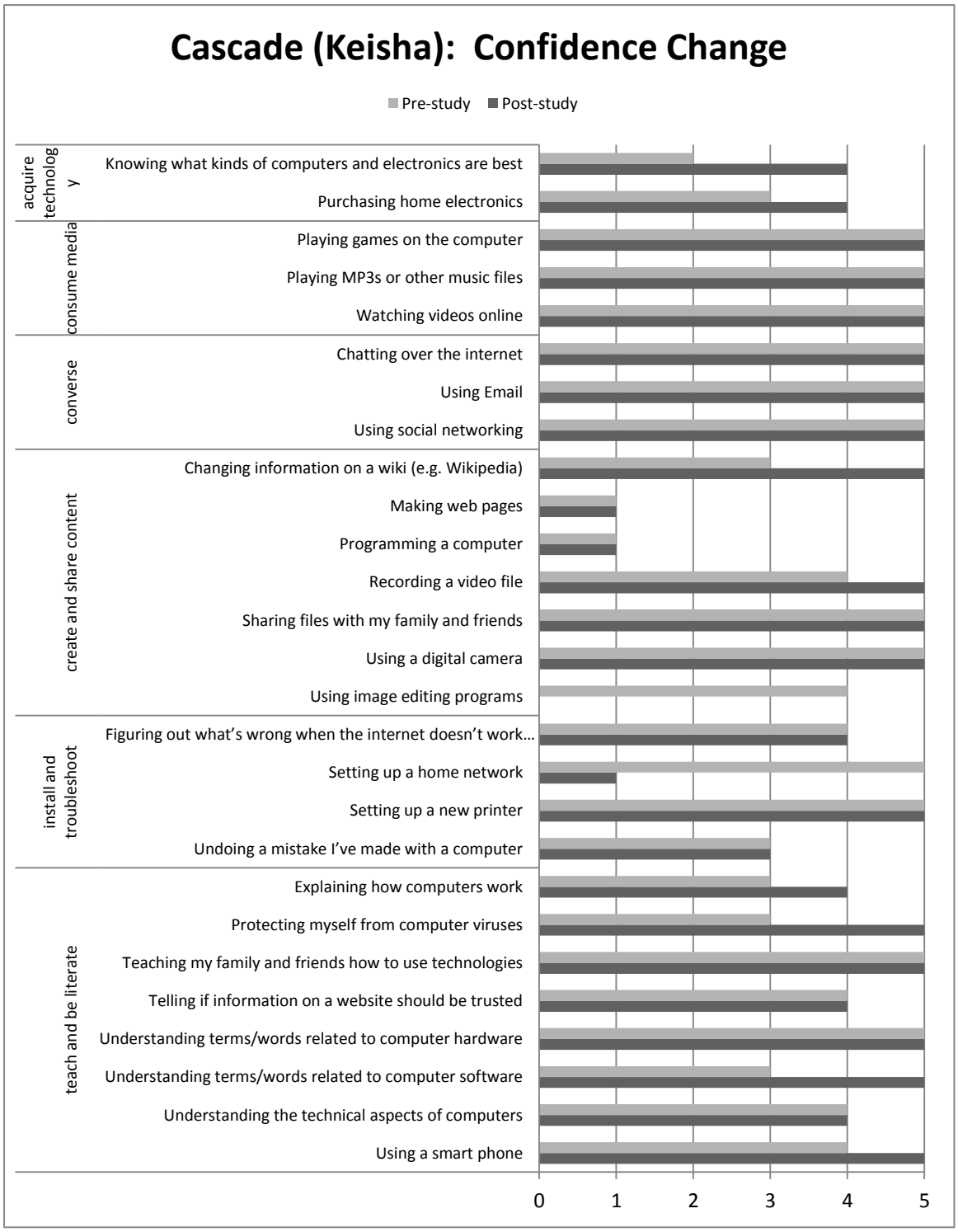
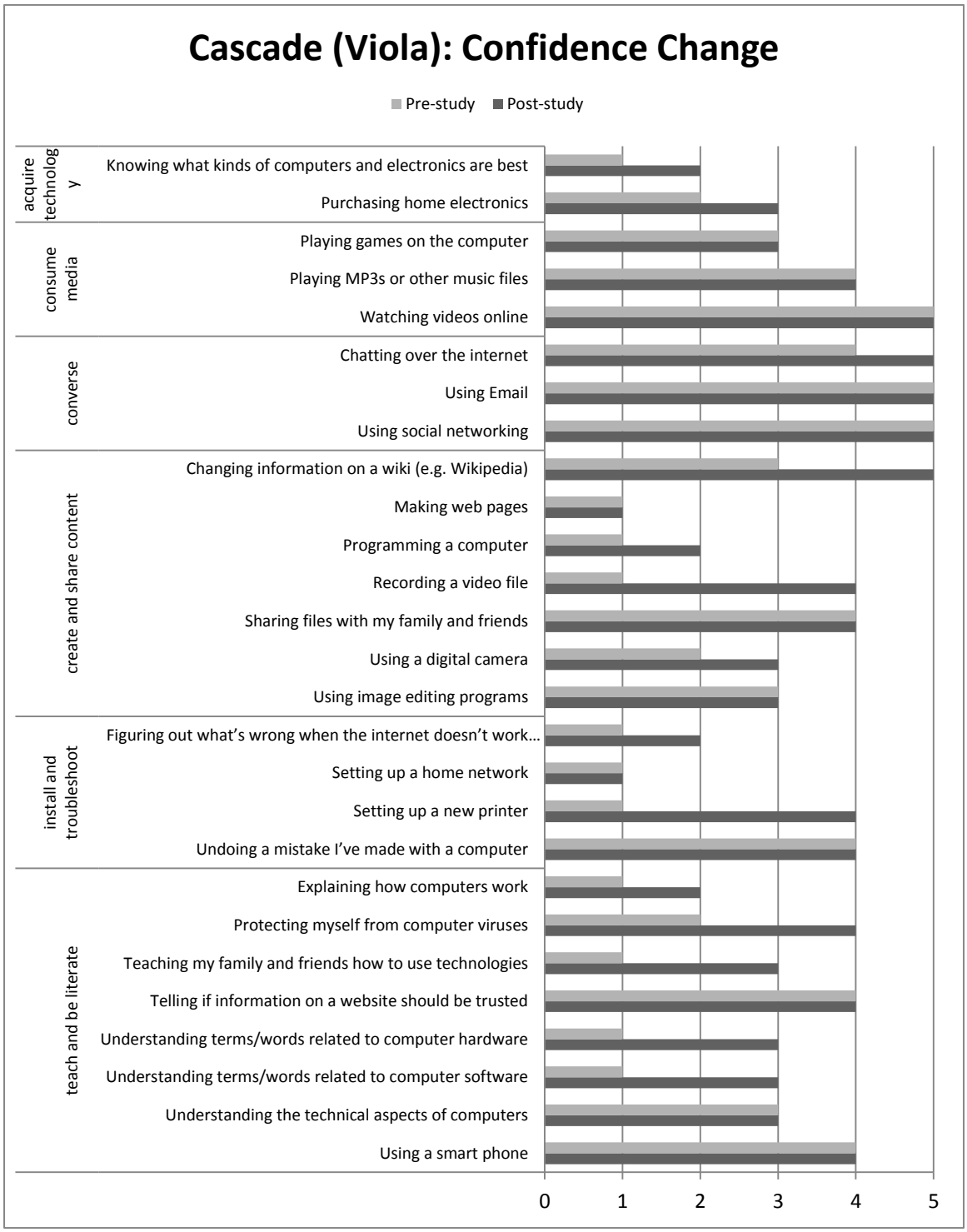


**Note: Keisha left "Using image editing programs" blank on her post-study survey*


Cascade (Viola): Confidence Change
Pre-study
Post-study
acquire technology
Knowing what kinds of computers and electronics are best
Purchasing home electronics
consume media
Playing games on the computer
Playing MP3s or other music files
Watching videos online
converse
Chatting over the internet
Using Email
Using social networking
create and share content
Changing information on a wiki (e.g. Wikipedia)
Making web pages
Programming a computer
Recording a video file
Sharing files with my family and friends
Using a digital camera
Using image editing programs
install and troubleshoot
Figuring out what's wrong when the internet doesn't work...
Setting up a home network
Setting up a new printer
Undoing a mistake I've made with a computer
teach and be literate
Explaining how computers work
Protecting myself from computer viruses
Teaching my family and friends how to use technologies
Telling if information on a website should be trusted
Understanding terms/words related to computer hardware
Understanding terms/words related to computer software
Understanding the technical aspects of computers
Using a smart phone
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C.4: Decatur


Decatur (Jillian): Confidence Change
Pre-study
Post-study
acquire technology
Knowing what kinds of computers and electronics are best
Purchasing home electronics
consume media
Playing games on the computer
Playing MP3s or other music files
Watching videos online
converse
Chatting over the internet
Using Email
Using social networking
create and share content
Changing information on a wiki (e.g. Wikipedia)
Making web pages
Programming a computer
Recording a video file
Sharing files with my family and friends
Using a digital camera
Using image editing programs
install and troubleshoot
Figuring out what's wrong when the internet doesn't work...
Setting up a home network
Setting up a new printer
Undoing a mistake I've made with a computer
teach and be literate
Explaining how computers work
Protecting myself from computer viruses
Teaching my family and friends how to use technologies
Telling if information on a website should be trusted
Understanding terms/words related to computer hardware
Understanding terms/words related to computer software
Understanding the technical aspects of computers
Using a smart phone
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Decatur (Mike): Confidence
Pre-study
Post-study
acquire technology
Knowing what kinds of computers and electronics are best
Purchasing home electronics
consume media
Playing games on the computer
Playing MP3s or other music files
Watching videos online
converse
Chatting over the internet
Using Email
Using social networking
create and share content
Changing information on a wiki (e.g. Wikipedia)
Making web pages
Programming a computer
Recording a video file
Sharing files with my family and friends
Using a digital camera
Using image editing programs
install and troubleshoot
Figuring out what's wrong when the internet doesn't work...
Setting up a home network
Setting up a new printer
Undoing a mistake I've made with a computer
teach and be literate
Explaining how computers work
Protecting myself from computer viruses
Teaching my family and friends how to use technologies
Telling if information on a website should be trusted
Understanding terms/words related to computer hardware
Understanding terms/words related to computer software
Understanding the technical aspects of computers
Using a smart phone
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C.5: Dunwoody


Dunwoody (Janine): Confidence Change
Pre-study
Post-study
acquire technology
Knowing what kinds of computers and electronics are best
Purchasing home electronics
consume media
Playing games on the computer
Playing MP3s or other music files
Watching videos online
converse
Chatting over the internet
Using Email
Using social networking
create and share content
Changing information on a wiki (e.g. Wikipedia)
Making web pages
Programming a computer
Recording a video file
Sharing files with my family and friends
Using a digital camera
Using image editing programs
install and troubleshoot
Figuring out what's wrong when the internet doesn't work...
Setting up a home network
Setting up a new printer
Undoing a mistake I've made with a computer
teach and be literate
Explaining how computers work
Protecting myself from computer viruses
Teaching my family and friends how to use technologies
Telling if information on a website should be trusted
Understanding terms/words related to computer hardware
Understanding terms/words related to computer software
Understanding the technical aspects of computers
Using a smart phone
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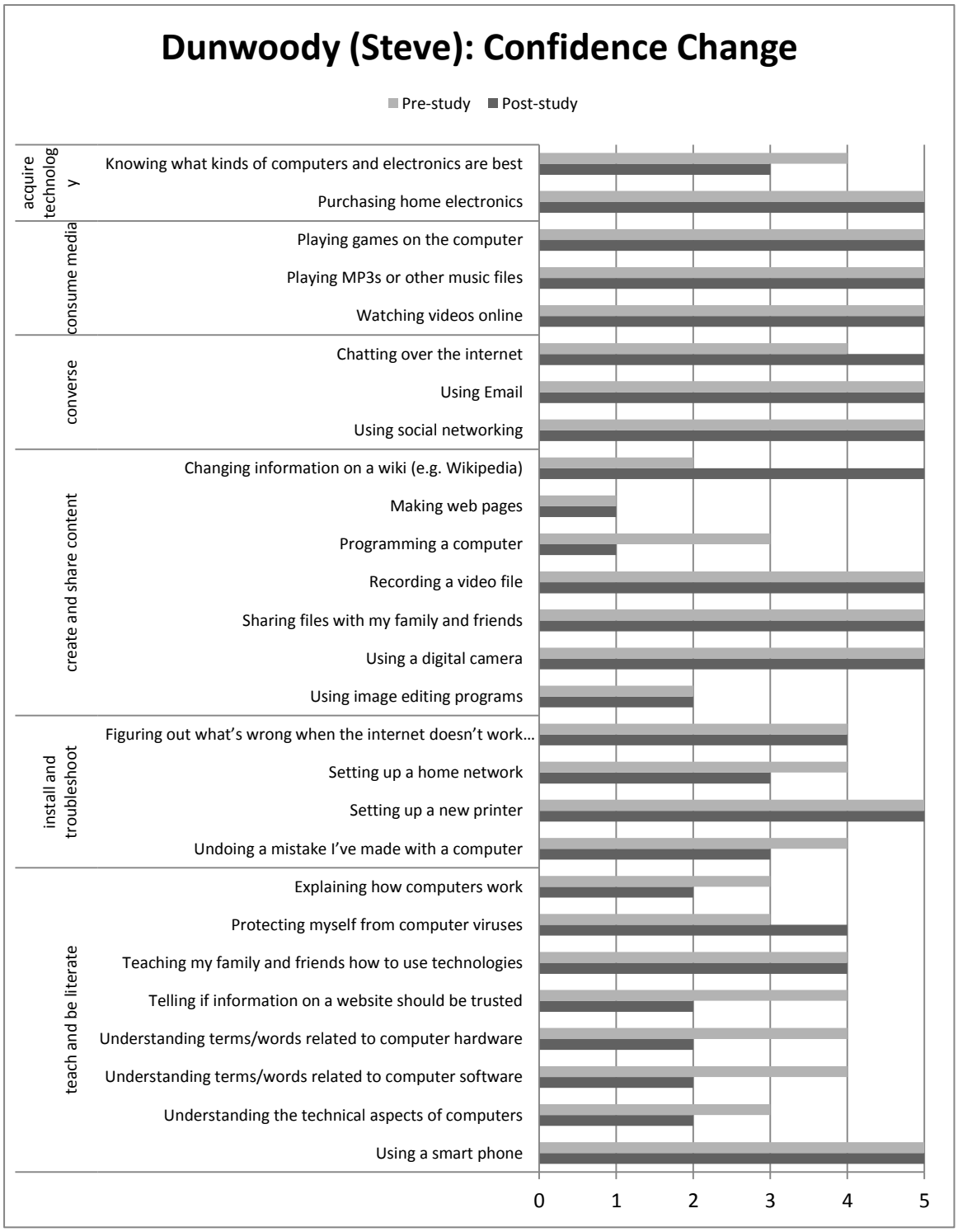
Dunwoody (Steve): Confidence Change
Pre-study
Post-study
acquire technology
Knowing what kinds of computers and electronics are best
Purchasing home electronics
consume media
Playing games on the computer
Playing MP3s or other music files
Watching videos online
converse
Chatting over the internet
Using Email
Using social networking
create and share content
Changing information on a wiki (e.g. Wikipedia)
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Using a digital camera
Using image editing programs
install and troubleshoot
Figuring out what's wrong when the internet doesn't work...
Setting up a home network
Setting up a new printer
Undoing a mistake I've made with a computer
teach and be literate
Explaining how computers work
Protecting myself from computer viruses
Teaching my family and friends how to use technologies
Telling if information on a website should be trusted
Understanding terms/words related to computer hardware
Understanding terms/words related to computer software
Understanding the technical aspects of computers
Using a smart phone
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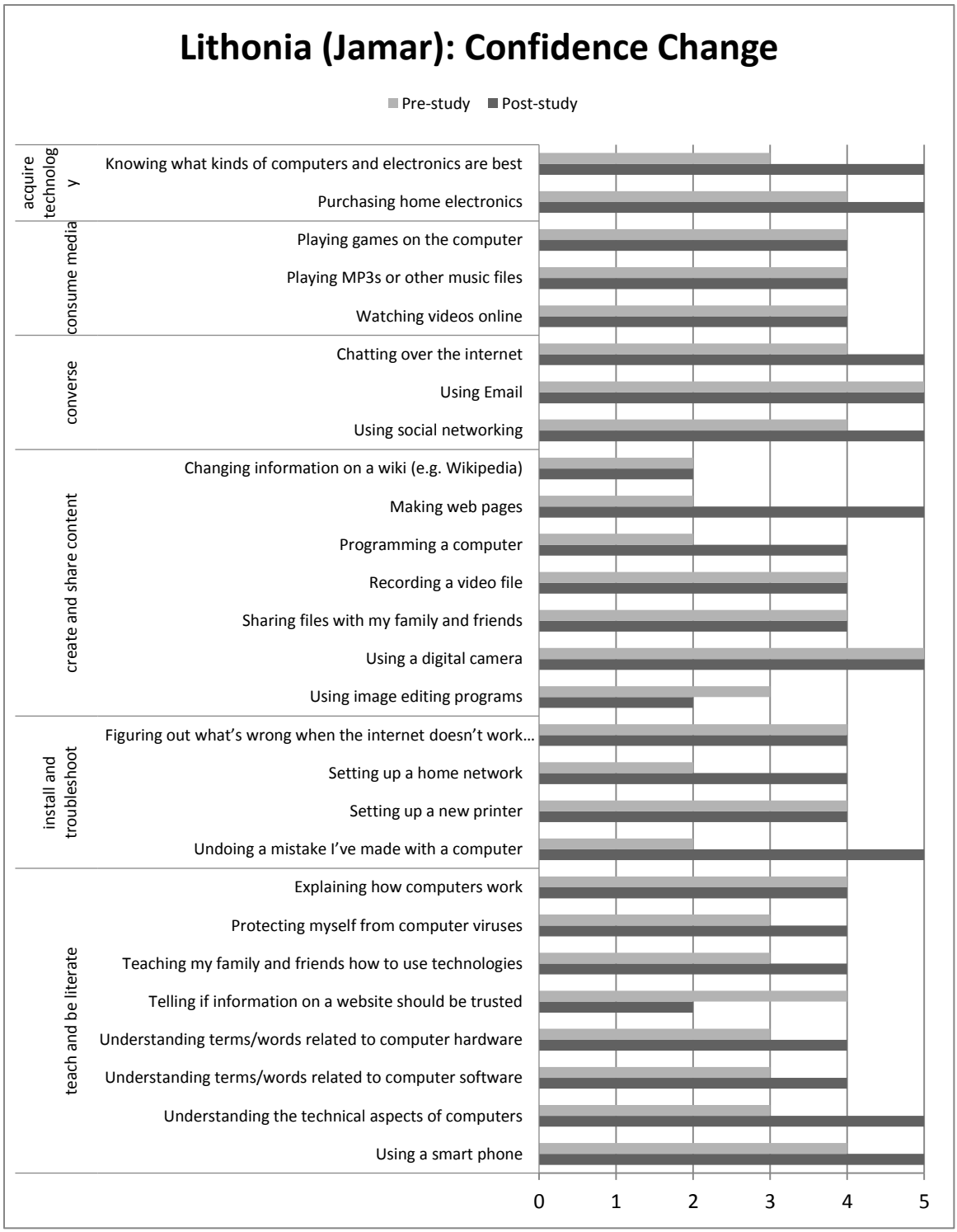
C.6: Lithonia


Lithonia (Deedra): Confidence change
Pre-study
Post-study
acquire technology
Knowing what kinds of computers and electronics are best
Purchasing home electronics
consume media
Playing games on the computer
Playing MP3s or other music files
Watching videos online
converse
Chatting over the internet
Using Email
Using social networking
create and share content
Changing information on a wiki (e.g. Wikipedia)
Making web pages
Programming a computer
Recording a video file
Sharing files with my family and friends
Using a digital camera
Using image editing programs
install and troubleshoot
Figuring out what's wrong when the internet doesn't work...
Setting up a home network
Setting up a new printer
Undoing a mistake I've made with a computer
teach and be literate
Explaining how computers work
Protecting myself from computer viruses
Teaching my family and friends how to use technologies
Telling if information on a website should be trusted
Understanding terms/words related to computer hardware
Understanding terms/words related to computer software
Understanding the technical aspects of computers
Using a smart phone
0
1
2
3
4
5


Lithonia (Jamar): Confidence Change
Pre-study
Post-study
acquire technology
Knowing what kinds of computers and electronics are best
Purchasing home electronics
consume media
Playing games on the computer
Playing MP3s or other music files
Watching videos online
converse
Chatting over the internet
Using Email
Using social networking
create and share content
Changing information on a wiki (e.g. Wikipedia)
Making web pages
Programming a computer
Recording a video file
Sharing files with my family and friends
Using a digital camera
Using image editing programs
install and troubleshoot
Figuring out what's wrong when the internet doesn't work...
Setting up a home network
Setting up a new printer
Undoing a mistake I've made with a computer
teach and be literate
Explaining how computers work
Protecting myself from computer viruses
Teaching my family and friends how to use technologies
Telling if information on a website should be trusted
Understanding terms/words related to computer hardware
Understanding terms/words related to computer software
Understanding the technical aspects of computers
Using a smart phone
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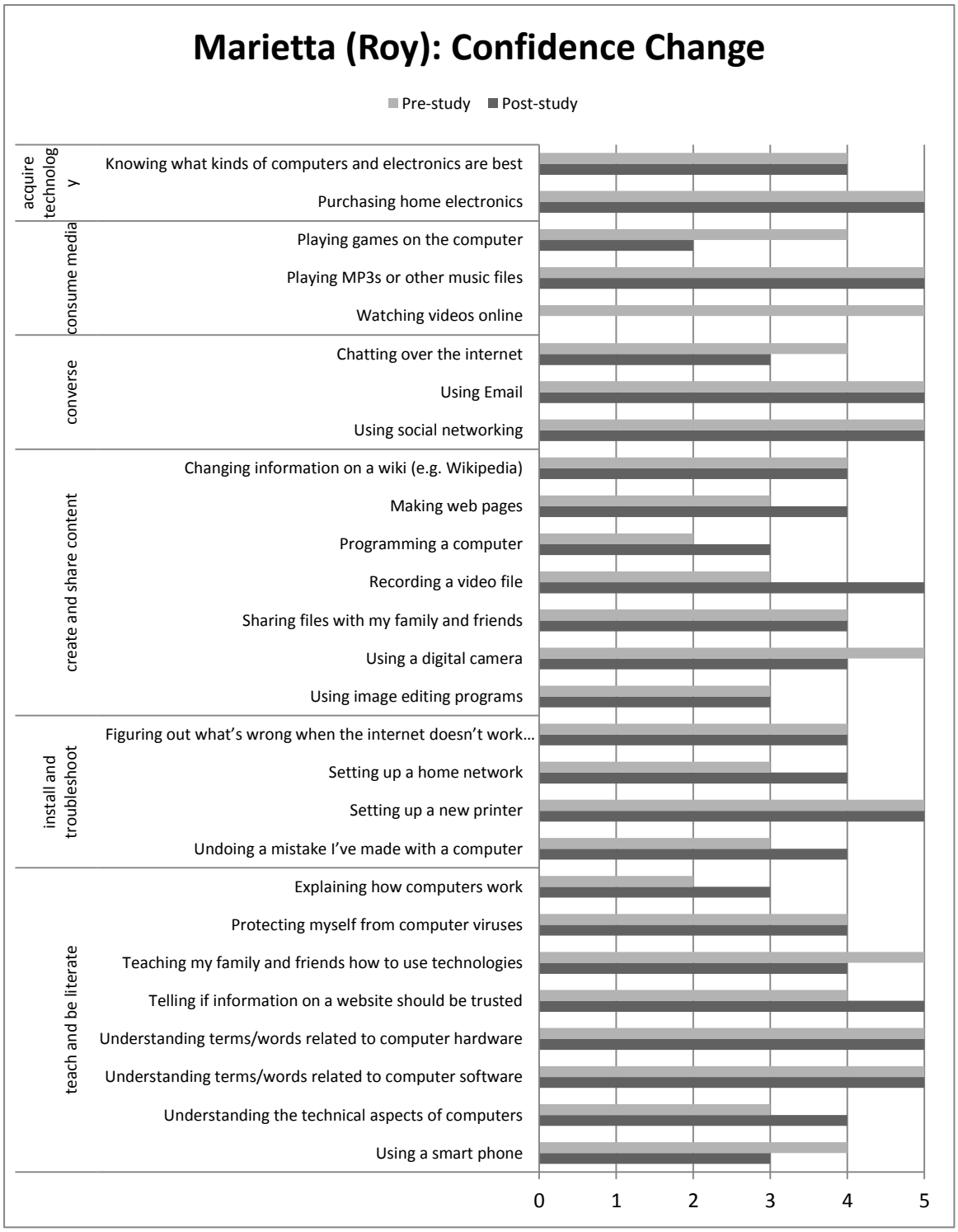
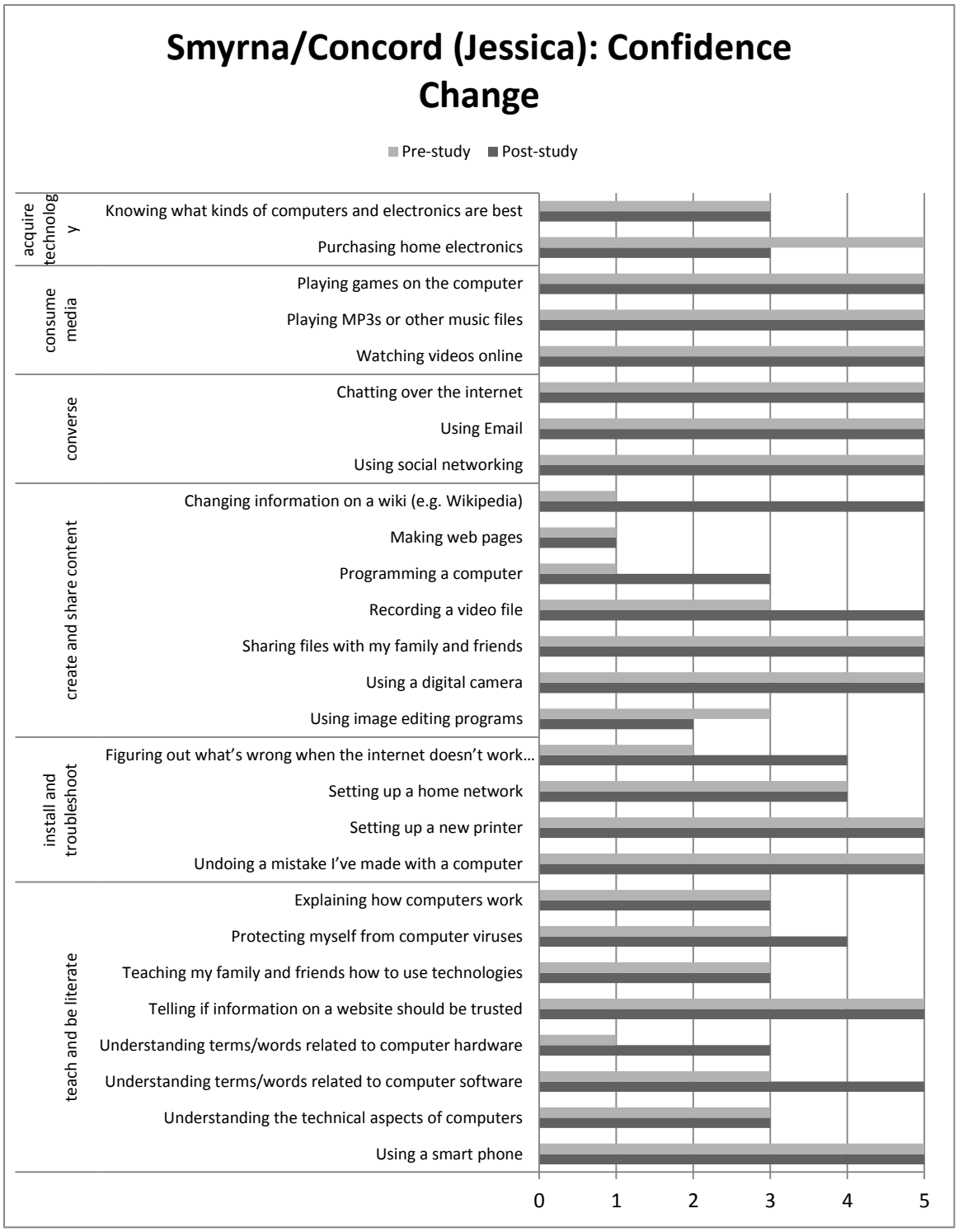
C.7: Marietta

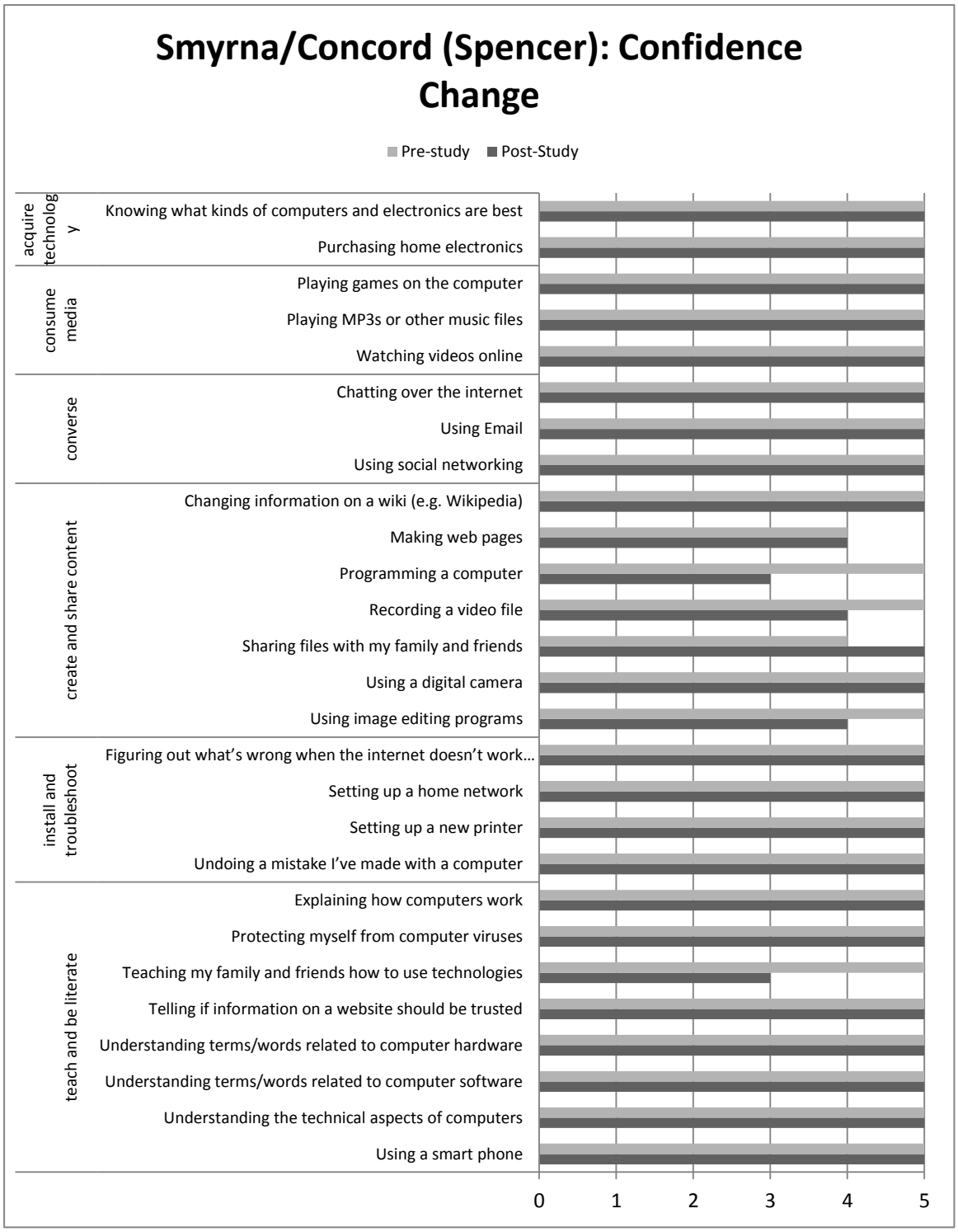
**Note: Karen left "Setting up a home network" blank on her post-study survey*



Note: Roy left "Watching videos online" blank on his post-study survey

C.8: Smyrna/Concord




Smyrna/Concord (Spencer): Confidence Change
Pre-study
Post-Study
acquire technology
Knowing what kinds of computers and electronics are best
Purchasing home electronics
consume media
Playing games on the computer
Playing MP3s or other music files
Watching videos online
converse
Chatting over the internet
Using Email
Using social networking
create and share content
Changing information on a wiki (e.g. Wikipedia)
Making web pages
Programming a computer
Recording a video file
Sharing files with my family and friends
Using a digital camera
Using image editing programs
install and troubleshoot
Figuring out what's wrong when the internet doesn't work...
Setting up a home network
Setting up a new printer
Undoing a mistake I've made with a computer
teach and be literate
Explaining how computers work
Protecting myself from computer viruses
Teaching my family and friends how to use technologies
Telling if information on a website should be trusted
Understanding terms/words related to computer hardware
Understanding terms/words related to computer software
Understanding the technical aspects of computers
Using a smart phone
0
1
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3
4
5

C.9: Woodstock/Hames


Woodstock/Hames (Matthew): Confidence Change
Pre-study
Post-study
acquire technology
Knowing what kinds of computers and electronics are best
Purchasing home electronics
consume media
Playing games on the computer
Playing MP3s or other music files
Watching videos online
converse
Chatting over the internet
Using Email
Using social networking
create and share content
Changing information on a wiki (e.g. Wikipedia)
Making web pages
Programming a computer
Recording a video file
Sharing files with my family and friends
Using a digital camera
Using image editing programs
install and troubleshoot
Figuring out what's wrong when the internet doesn't work...
Setting up a home network
Setting up a new printer
Undoing a mistake I've made with a computer
teach and be literate
Explaining how computers work
Protecting myself from computer viruses
Teaching my family and friends how to use technologies
Telling if information on a website should be trusted
Understanding terms/words related to computer hardware
Understanding terms/words related to computer software
Understanding the technical aspects of computers
Using a smart phone
0
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2
3
4
5

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