

Computer Help at Home: Methods and Motivations for Informal Technical Support

Erika Shehan Poole, Marshini Chetty, Tom Morgan, Rebecca E. Grinter, and W. Keith Edwards

GVU Center and School of Interactive Computing

Georgia Institute of Technology

85 5th St NW

Atlanta, GA 30308 USA

{erika, marshini, baggins, beki, keith}@cc.gatech.edu

ABSTRACT

Prior research suggests that people may ask their family and friends for computer help. But what influences whether and how a “helper” will provide help? To answer this question, we conducted a qualitative investigation of people who participated in computer support activities with family and friends in the past year. We describe how factors including maintenance of one’s personal identity as a computer expert and accountability to one’s social network determine who receives help and the quality of help provided. We also discuss the complex, fractured relationship between the numerous stakeholders involved in the upkeep of home computing infrastructures. Based on our findings, we provide implications for the design of systems to support informal help-giving in residential settings.

Author Keywords

home computing, help-giving, help-seeking, identity management, social networks

ACM Classification Keywords

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

INTRODUCTION

In the 1980s, personal computers were adopted into American homes and by the mid-1990s, US households also became connected to the Internet. Since then, these households have rapidly adopted networked computing equipment and broadband connections in their homes; as of early 2007, nearly half of all households in the US had broadband connections [1]. Coupled with increased broadband adoption, the number of devices within the

home, as well as the complexity of the infrastructure connecting these devices, has increased. Despite the rapid uptake of residential networked computing, however, a number of researchers have remarked on user experience difficulties associated with home computer and network setup, maintenance, and troubleshooting [8,10,12,15,17,20,30,32,34]. Moreover, as residential computing infrastructures have become more complex, professional technical support services have not sufficiently matured alongside the technologies [10,15,30].

Thus, residential computing infrastructure setup and maintenance requires having someone with technical knowledge to take primary responsibility for the care and maintenance of these computing systems. But 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?

People without such expertise or digital interests may turn to their wider social networks—family and friends who do not live in their homes—to provide help with computing problems. This mode of relying on social networks for computer help has become common in many homes, so understanding current practice—and how we may best support it—is crucial as we introduce even more complicated technological infrastructures into residential settings. But who are the people who provide informal technical support? What methods do they use to solve problems? What are their motivations for providing help? What challenges do they face?

In this study, we interviewed sixty people who participate in informal technical support activities—either as a provider or recipient of technical help—to learn more about the current informal technical support landscape. Our contribution is to provide information about computer helping practices in residential settings as well as the motivations for participation in informal technical support. Our study also uncovers a complex, fractured relationship between the various stakeholders involved with the setup and maintenance of residential computing infrastructures.

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.

CHI 2009, April 3–9, 2009, Boston, MA, USA.

Copyright 2009 ACM 978-1-60558-246-7/08/04...\$5.00

In the remainder of the paper, we first discuss related work in home networking, technical support, and informal help-giving. We then provide details about how we conducted the study, findings about how and why people provide help, and implications for the design of tools to support informal technical help-giving for home computing.

RELATED WORK

Perhaps the earliest study of technical support in the home is the HomeNet project [20], which investigated the dynamics of help-seeking behavior for residential computing related issues in the mid-1990s. The study tracked 93 families for a year as they began to use the Internet. Since computer and Internet adoption were not widespread at the time, the researchers provided each family with a computer, modem, Internet service, training, and access to a help desk. The researchers found that family members tended to seek help from others in the family before resorting to calling the help desk (to avoid waiting for help or having to explain their problem in technical terms). 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. This guru mediated calls to the external help desk and customized the family computer. Franzke and McClard [12] also reported on the HomeNet project. They describe that teenagers enrolled in the study received more help from people within their social networks, whereas adults relied more on assistance from formal resources such as telephone help lines. The authors noted that parents in the study became reluctant to ask their children for help after having a negative experience doing so.

In contrast, our study offers a picture of computing help in a time when householders not only have more experience with computers, but also are living in much richer computational environments. Since the mid-1990s, home computer use has proliferated. Additionally, households have also shifted from owning a single machine to owning multiple computers, leading to contention for a single Internet connection. This need to share Internet access among devices has been exacerbated by the increased proliferation of home electronics that rely on some type of network connectivity to provide functionality, systems such as Personal Video Recorders (e.g., TiVo™). Consequently, increasing numbers of households find themselves engaged in some sort of home networking. This upward trend in home networking has led to a new class of research within the CSCW and HCI communities upon which our work builds. Unlike the HomeNet project, in which participants were provided with the computer, modem, and access to the Internet, researchers can now study home computing and networking issues in the wild (e.g., [8,10,15,32,34]). A dominant focus in this newer research has been to highlight the collaborative nature of home networking, particularly among the householders themselves. For instance, Grinter et al. [15] found that householders have to collaborate with each other to make the network work. Their study also

found that one person in the home typically becomes a guru who helps less technically minded occupants; however, since this study focused on dual-income couples, the guru role was not relegated to a teenager in any of the households. Chetty et al. [10] found that the guru role in households with children no longer necessarily falls upon teenagers, but rather (as in the Grinter et al. study [15]) to the most technically knowledgeable individual in the house. Poole et al. [29] defined additional roles in the household, 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. Tolmie et al. [34] elaborate on the difficulties of maintaining networked computing. They define a concept called “digital housekeeping.” This activity is marked not by explicit troubleshooting activities but by broader concerns about how networking integrates into all aspects of home life. In other words, they focused on how home networking activities are worked into broader domestic routines of the household. They also describe how troubleshooting, maintenance, and setup are complex activities within the home, relying on householders coordinating with each other (e.g., planning to do tasks when others are not present to avoid disturbing their routine use of the network).

What happens, however, when there is no computing expert within the home, or even anyone with interest in computing setup and maintenance activities? To date, the dominant focus of home computing research has examined *household work* to make networked computing infrastructures work, though some researchers have studied how householders seek technical help from phone support lines [6,20,30], and from Internet-based resources, such as online how-tos [35], question and answer forums [4], FAQs [16], and tutorials [28]. In contrast, we examine technical help-seeking and help-giving by people who have offline friend and family relationships with one another, but do not necessarily live within the same household.

A long-standing body of work addresses how people seek and receive technology help in organizational settings. This research has found technical help-seeking within the workplace is a highly social activity; in the workplace, people often seek help from coworkers who are known to them, and “local experts,” “tailors,” or “gurus” often emerge within organizational settings (cf. [2,3,5,9,21,22,24,27,36] among others). Yet there are also a number of differences between technical help-seeking in organizational settings and in residential settings. We return to these differences in the discussion section.

METHODS

In this paper, we are not making claims about the proportion or prevalence of technical help-giving that occurs within one’s social network as opposed to other means such as professional technical support; rather we are elucidating the motivations and practices of informal help-giving when it does occur. Our data comes from semi-

structured interviews with sixty people who participated in informal technical support in the past year. We were able to examine both help-seeking and help-giving. 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 they help, people who provide help to 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. The interviews were recorded and transcribed.

Rather than using a hypothesis-driven approach to analyze data, we arrived at categories of interest through inductive reasoning, following in the traditions of a number of qualitative analysis techniques [33]. Three analysts coded interviews independently, and then worked together to arrive at mutually agreed upon themes. The excerpts that appear in this paper are representative examples of commonly occurring themes in the data. In addition to analyzing the data for categories of interest, we 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 [13], are developed using qualitative interview data, and provide explanatory power about how and why members of groups make choices. They aim to predict decision making with an 85-90% accuracy rate; while they do not explain every possible nuance of help-giving, they do provide insight into a majority of instances based on empirical data.

In this study, we developed two ethnographic decision models. For each model, we traced through the accounts participants provided about who was helped, and how they were helped. We iteratively refined the models based on the data from each successive participant. The first model, described in **Figure 1**, explains the factors that influence whether a helper will provide help to a particular person. The second model, described in **Figure 2**, explains the factors that influence how a helper will go about providing help to a particular person.

FINDINGS

From here onwards, we refer to participants who provide collaborative support to households as *helpers* and those who receive outside technical assistance as *seekers*. We note, however, that these distinctions are not always exclusive. In some cases, participants who usually provide help may engage in seeking behavior, and vice versa.

Our results show that reasons for choosing informal support over professional services include cost, convenience, comfort, and trust. For instance, friends and family members did not require payment for their time and services, were perceived as being easier to contact than

most formal technical support options (which might entail finding a support phone number on an equipment box and waiting on hold to talk with a support person), were trusted members in their social networks, and knew more about the particular ways that the networks and devices were configured than a professional technician might know. Helpers reported assisting family members and roommates who lived in the same home as well as family and friends who either lived geographically nearby (e.g. in the same city) or at a distance (e.g. in another country).

In the following sections, we expand on the characteristics of informal technical support networks. First, we describe motivations for seeking informal help. Second, we describe how helpers become informal technical support contacts for their social networks and the collaborative strategies that they use to help with technical problems both remotely and in-person. Third, we discuss how the act of helping in itself is intricately tied in with one's personal identity as well as accountability to one's larger social network. We discuss methods of providing help, and the challenges posed by these methods.

Motivations for Seeking Informal Help

Seekers described a number of reasons for requesting help from within their social networks; perhaps the largest motivation for seeking help from family in friends is that this sort of support is a long-term relationship with one point of contact. A number of helpers reported that their family and friends often did not know where to look for help resources on their own. 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.

Even if they did find the correct contact for professional support, however, their experiences were not always satisfactory. One seeker remarked on the disappointment she experienced with the lack of help she received from a manufacturer's online forum:

S04: I posted to the forum and never got a reply. It really feels like the company messed up and just forgot about the customers

Even if the help provided is satisfactory, the *amount* of help one can receive in-person or over the phone is often limited, either by policy or by cost. Remarkd a seeker:

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.

In-person and telephone-based support services also require significant time commitments. Calling technical support lines involved navigating lengthy automated menus and waiting on hold. In-person help involved long waits for technicians to arrive. Moreover, once these help resources were available for the seeker, additional time could be spent retrying troubleshooting steps that had already been taken.

In contrast, help provided by one's social network offers a number of appealing benefits. First, the time and financial costs are lower, and the help is often provided as part of a longer-term relationship. The person who is providing help often understands the technical competence of the seeker and the technical environment within the seeker's home, and can calibrate solutions accordingly.

Motivations for Providing Informal Help

Helpers 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. While growing up, they 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 years ago in the context of their jobs, or had been electronics hobbyists for years.

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 savvy with word of their technical prowess quickly becoming known to family and friends.

H15: Well, I mean, 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... And, I mean, in, 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 helpers overwhelmingly reported that the joys of providing technical support quickly faded. As their 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, helpers commonly reported 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. Despite this sentiment, helpers continued providing technical support primarily out of a sense of obligation those in their social network. For some, this obligation was an expression of caring for family and friends. Remarkd 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

Primarily driven to help out of a sense of accountability to their close family and friends, helpers also took steps to limit access to their services. For instance, this same participant discussed how he actively restricted access to his technical support services to family and close friends only:

H27: There is a point where you have to draw the line...when my wife's you know, my wife's good friends' friend calls me, I'm like 'sorry bro' or 'sorry kid, I can't help you'

However, these attempts at access control did not always work. Sometimes close members of the social network pressured helpers into assisting people who were normally out-of-bounds. As one helper noted:

H12: I always hated that my mom agreed for me to help her friends without my permission.

Interviewer: Oh, why?

H12: Because 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.

Other helpers could not bring themselves to explicitly deny access to people outside of their immediate social network. One helper attempted using hourly charges for his services to discourage people at the periphery of his social network from asking for help. This strategy, however, backfired. By charging high prices, it only bolstered his reputation as a computer 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?'

Others reported that they would intentionally provide a lower quality of help to those they did not know well, a point we will return to later:

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.'

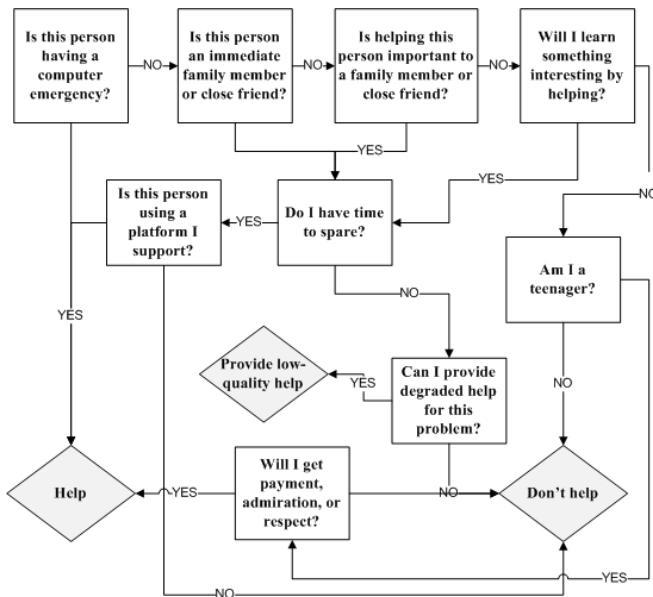


Figure 1: Factors influencing decisions to help

Even younger helpers motivated primarily by personal gain spoke of limiting access, in particular to people they perceived as having uninteresting problems:

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, providing help was initially satisfying but faded as problems became mundane, and free time became scarce. As help-giving became more of an obligation than a fun activity, helpers took a number of steps to restrict access to their services.

Deciding Whether to Help

Helpers developed a number of strategies of how—and how much—they would help people. To better understand the decision making process that occurs when help is provided, we 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. In **Figure 1**, we describe the decision process of deciding whether to help someone. In **Figure 2**, we describe the process of deciding how to go about providing help. We find that in particular, help strategies are influenced by the amount of time the seeker has available for helping, perceived urgency of the situation, accountability to the person requiring help, and perceived personal gain for solving the problem.

The first consideration made by helpers is the *urgency* of the situation. In a “computer emergency,” helpers were

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. Secondly, both helpers and seekers described *time* as an important factor to consider when asking for informal help. If a problem were perceived as requiring a short amount of time to fix, then helpers were more likely to provide assistance. Seekers, too, were aware of placing a time burden on helpers. Yet their attempts to minimize the amount of time that helpers spent assisting their problems at times caused more problems than either helpers or seekers intended, a point we return to later. Third, the *relationship with the person* requesting help is another factor influencing whether to help. If the person desiring help were a close member of one's social network, then help would more likely be provided. Fourth, if the problem offered the helper some *personal gain*—for instance an interesting learning experience or the respect of others—then it is more likely that help would be provided.

Deciding How to Help

In this section, we describe how informal technical support occurs. Our 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*. 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. We discuss the benefits and challenges afforded by each of these approaches, starting first with remote help, and then moving to in-person help.

Remote Help

Helpers provide remote consultations to all members of their social networks. Helpers were viewed as knowledge sources about anything electronic by virtue of having worked with computers for a long time or being enrolled in a computer-related degree program. Said one helper:

H27: There was a running joke [among my classmates] like, everybody's parents think that you're getting your degree in tech support. Like that what you do is sit around the university configuring AOL to dialup from various locations.

Several helpers reported that seekers would call them to ask for advice on tasks such as burning CDs, copying and pasting text, or how attaching 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 unfamiliar operating system dialog boxes when they appeared.

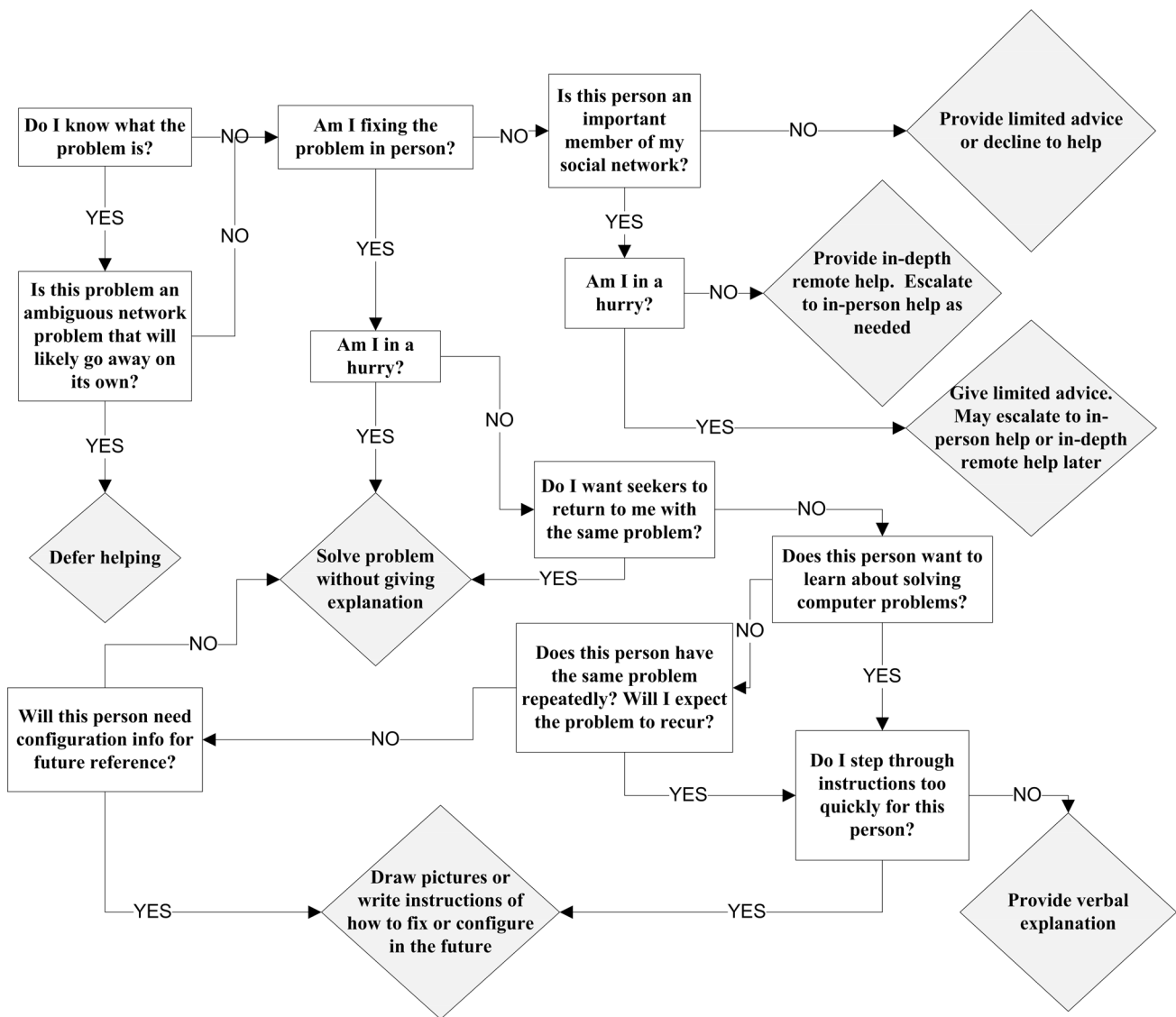


Figure 2: Factors influencing how remote and in-person help is provided

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. Firstly, during the setup process, helpers preemptively took steps that would allow them to troubleshoot future problems remotely. 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. 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 IM or 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 the phone or IM. While all participants had tried using the phone at least once for giving or receiving help, they were varied in terms of using 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 can't 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 five 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 casually dismiss if they were too busy.

IM, however, also offered 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:

Interviewer: So, do you think IM works for almost every problem?

H06: No, I don't think so. Like, if it's the computer's problem itself. Like one time, I was installing a hard drive and I didn't know how to do it, you can't IM for that (laughs). You have to talk.

Physical requirements also played into reasons for not using IM if possible. 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).

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.

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. 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, seekers were often 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.

The Trouble With Time

Whether in person or remote, , attempts to avoid wasting the helper's time often resulted in additional helping episodes in the future. 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, 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 questions at all about what the helper was doing because they thought that the best thing they could do is let the helper work quickly. Others who asked questions were sometimes 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, when problems recurred, seekers would not know how to solve them because they did not understand the fixes the first time around.

Managing Expert Identity

Finally, we would like to draw attention to how a helper's management of his or her own identity as a "computer expert" also plays a role in problem selection and problem solving. 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

Our findings suggest that there is much active “front stage” work helpers do in order to maintain seekers’ perception of them as computer experts [14]. As mentioned earlier, helpers may *downplay* their identity as experts to forestall being asked for help (as in the earlier quote from the helper who hid his expertise from his high school librarian). But most took steps to maintain an aura of expertise. This aura of expertise is closely managed through careful selection of *which* problems to solve (those that they *can* solve, and that thus maintain seekers’ perceptions of them), how they solve problems, and how they account for unsolvable problems. 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 [27].

Some participants described avoidance of helping when they felt uncomfortable in their abilities to solve the task:

H16: I am very quick to say that if I don’t know then I don’t know. I don’t believe in wasting people’s time saying ‘well, let me see here’ and try to come up with something... [but] I am pretty quick to offer help if I know exactly what they’re asking for.

Helpers mentioned that they felt extremely uncomfortable with helping someone and not being able to resolve the problem:

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.

To overcome this discomfort, helpers would look up reference material—typically from online resources—in advance of in-person visits in order to be prepared to solve the problem. Additionally, although rare, a few helpers withheld information from seekers about how to fix problems in order to preserve their reputation as computer experts:

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.

When helpers encountered problems they could not solve, however, they sometimes felt inadequate and had to find strategies to explain this to seekers without losing face:

H07: It can be frustrating, especially if you can’t find the problem solution and it gets you thinking after the conversation is over. It stays with you for awhile. You feel disappointed if you can’t 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.

Similarly, helpers reported frustration when their professionalism and motives for helping were questioned. Said two helpers:

H26: Sometimes people look at me and go ‘What are you doing?’ ...Sometimes I have to open up the computer, and take out some part to check if it is burned. Some people get frustrated. But I am supposed to do it. When they look at me like I’m going to steal something, I don’t like it.

H03: Sometimes I think they only reason they’re showing, they’re standing over my shoulder is maybe they think I’ll find something on their computer they don’t want me to see. So they’re making sure I’m not traversing any folders that I shouldn’t be looking through.

Even with an informal support network in place, however, helpers and seekers at times had to deal with outside stakeholders involved with the upkeep of home computing infrastructures, including service providers, software companies, and hardware manufacturers. Helpers reported frustrating experiences establishing their identity as computer experts when dealing with these outside stakeholders. Often, these experiences were described as a waste of time; whether in person or remotely, participants would have to spend too much time establishing that they either knew the cause of a problem, or had already completed simple troubleshooting steps. Problems that intersected the domains of multiple service providers added additional complications. One participant’s experience helping his father set up a new computer with Internet access reflects both of these issues.

H36: 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’all’s’ 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.

In summary, helpers take active steps to manage their identity as computer experts. When this identity is shaken—either by an unsolvable problem, an untrusting seeker, or an unfamiliar outsider—it can frustrate the help providing process.

DISCUSSION

Our study illustrates not only the nature of informal technical support, but also the challenges that arise from the landscape of deeply heterogeneous networking that is increasingly finding its way into homes. In this paper, we describe how helpers arrive into their roles of informal help providers. We also describe how helpers decide who, when,

and how to provide help, and how accountability and personal identity influence help-giving strategies.

Technology-help giving, however, is not a new subject of study. There is a long history of research focused on how technological help-seeking and help-giving occurs, particularly in workplaces. Although there are similarities between technological help-seeking in residential and workplace settings (e.g. asking familiar people for help, or refraining from asking for too much help in order to avoid bothering helpers), there are also striking differences. In particular, research in organizational settings notes that physical proximity is one of the largest indicators of who will be called upon as a helper; we did not see this trend reflected in our research. Instead, some help seekers would wait for months until their preferred helper (e.g. a child away at college) visited. Rather than asking someone nearby for help whenever a problem occurred, help seekers were more likely to queue up questions until the preferred helper was available, or ask for help remotely.

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. [7,11,21-23,37]). Yet we did not see this trend in our data. This preference for help from peers may be due to workplace reward structures, and differing requirements for managing one's identity within the workplace. 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 for help from peers or avoid asking for help all together.

Similarly, those who *provide* help within the workplace also engage in different sorts of identity management practices that do not apply within home environments (cf. [7,21,24]). Workers must balance their roles as helpers with their work duties and not be perceived as spending too much time helping. In residential settings, however, being a helper to one's parents does not detract from one's role of being a child, nor does a helper in a residential setting need to convince management to reward these technical helping activities. Furthermore, accountability to providing help to another differs between home and workplaces; in many cases, there is a much lower accountability to providing help to one's coworker than one's mother at inconvenient times.

Given this information, how can we better support technical help-giving within residential settings? Some research efforts within HCI and related disciplines have focused on making written help documentation more effective [25,31], creating user interface components that direct people to relevant help information on a screen [18,19], or

automating aspects of configuration and troubleshooting tasks [26,38,39]. While these systems take technology- or usability-centric approaches for addressing support difficulties, we instead advocate for recharacterizing technology help as a problem that requires study of *existing social practices and routines*. Because of the long-term relationship with informal technical support that seekers form with helpers, we do not see the role of this type of support for home computing fading away over time. By acknowledging and designing for these existing practices and routines, we can forge new directions for the design of technology help systems appropriate for residential settings. Supporting helpers in their roles is an important aspect of future domestic computing infrastructures.

CONCLUSION

Our study examined practices and problems surrounding informal technical support of computing and network problems in residential settings. We described how and why assistance is provided, based on ethnographic decision models derived from empirical data provided by sixty people who participate in informal technical support activities. We note that helpers take steps both to manage access to their services, as well as to manage their personal identity as a "computer expert." This management of access and identity shapes the quantity and quality of informal technical support practices. We conclude with a discussion of how to design future residential computing infrastructures with informal technical support mechanisms in mind, advocating for the design of residential computing help systems that take into account existing social practices.

ACKNOWLEDGEMENTS

This work was supported by an NSF Graduate Research Fellowship, NSF-CNS #0626281, and a supplemental NSF REU award for the undergraduate researcher involved with this project. We especially thank the students enrolled in the Spring 2008 offering of the Georgia Tech course CS 4690/CS 6455 for assisting with data collection.

REFERENCES

1. Pew Internet & American Life Project. Home Broadband Adoption, June 2000.
2. Ackerman, M.S. Augmenting organizational memory: a field study of answer garden. *ACM Trans. Inf. Syst.*, 16, 3 (1998), 203-224.
3. Ackerman, M.S. and McDonald, D.W. Answer Garden 2: merging organizational memory with collaborative help, In *Proc. of CSCW 1996*, 97-105.
4. Adamic, L.A., Zhang, J., Bakshy, E. and Ackerman, M.S. Knowledge sharing and yahoo answers: everyone knows something. In *Proc. of WWW 2008*, 2008, 665-674.
5. Allen, T.J. *Managing the Flow of Technology*. MIT Press, Cambridge, 1977.
6. Baker, C.D., Emmison, M. and Firth, A. Calibrating for Competence in Calls to Technical Support. in *Calling for Help: Language and Social Interaction in*

- Telephone Helplines*, John Benjamins, Philadelphia, 2005, 39-62.
7. Bannon, L. Helping users help each other. *User Centered System Design: New Perspectives on Human-Computer Interaction* (1986), 399-410.
 8. Bly, S., Schilit, B., McDonald, D.W., Rosario, B. and Saint-Hilaire, Y., Broken Expectations in the Digital Home. In *Proc. of CHI 2006*, 68-573.
 9. Bobrow, D.G. and Whalen, J. Community Knowledge Sharing in Practice: The Eureka Story. *Reflections*, 4, 2 (2002), 47-59.
 10. Chetty, M., Sung, J.-Y. and Grinter, R.E. How Smart Homes Learn: The Evolution of the Networked Home and Household In *Proc. of Ubicomp 2007*, 127-144.
 11. Clement, A. Cooperative Support for Computer Work: a Social Perspective on the Empowering of End Users *Proc. of CSCW 1990*, 223-236.
 12. Franzke, M. and McClard, A. Winona gets wired: technical difficulties in the home. *Communications of the ACM*, 39, 12 (1996), 64-66.
 13. Gladwin, C. *Ethnographic Decision Tree Modeling*. Sage, 1989.
 14. Goffman, I. *The Presentation of Self in Everyday Life*. Doubleday, Garden City, 1959.
 15. Grinter, R.E., Edwards, W.K., Newman, M.W. and Ducheneaut, N. The Work to Make a Home Network Work In *Proc. of ECSCW 2005*, 469-488.
 16. Halverson, C.A., Erickson, T. and Ackerman, M.S., Behind the Help Desk: Evolution of a Knowledge Management System in a Large Organization. In *Proc. CSCW 2004*, 304-313.
 17. Horrigan, J.M. and Jones, S. *When Technology Fails*. Pew Internet & American Life Project. Nov. 2008.
 18. Huang, J. and Twidale, M.B. Graphstract: Minimal Graphical Help for Computers. In *Proc. UIST 2007*, 203-212.
 19. Kelleher, C. and Pausch, R. Stencils-based tutorials: design and evaluation. In *Proc. CHI 2005*, 541-550.
 20. Kiesler, S., Zdaniuk, B., Lundmark, V. and Kraut, R. Troubles with the Internet: The Dynamics of Help at Home. *Human-Computer Interaction*, 15 (2000), 323-351.
 21. Lang, K., Auld, R. and Lang, T. The goals and methods of computer users. *International Journal of Man-Machine Studies*, 17, 4 (1982), 375-399.
 22. Lee, D.M.S. Usage Pattern and Sources of Assistance for Personal Computer Users. *MIS Quarterly*, December 1986 (1986), 313-325.
 23. Lee, F. The Social Costs of Seeking Help. *Journal of Applied Behavioral Science*, 38, 17 (2002), 17-35.
 24. Mackay, W.E. Patterns of sharing customizable software In *Proc. CSCW 1990*, 209-221.
 25. Mehlenbacher, B. Documentation: Not Yet Implemented but Coming Soon! in *The HCI Handbook: Fundamentals, Evolving Technologies, and Emerging Applications*, Lawrence Erlbaum, 2003, 527-543.
 26. Newman, M.W., Elliott, A. and Smith, T.F. Providing an Integrated User Experience of Networked Media, Devices, and Services Through End-User Composition In *Proc. of Pervasive 2008*, 213-227.
 27. Orr, J. *Talking about Machines: An Ethnography of a Modern Job*. ILR Press, 1996.
 28. Perkel, D. and Herr-Stephenson, B. Peer pedagogy in an interest driven community: The practices and problems of online tutorials. *Media@lse Fifth Anniversary Conference*, London, UK, 2008.
 29. Poole, E.S., Chetty, M., Grinter, R.E. and Edwards, W.K. More Than Meets the Eye: Transforming the User Experience of Home Network Management. In *Proc. of DIS 2008*, 455-464.
 30. Poole, E.S., Edwards, W.K. and Jarvis, L. The Home Network as a Socio-Technical System: Understanding the Challenges of Remote Home Network Problem Diagnosis. *Journal of Computer-Supported Cooperative Work (in press)* (2008).
 31. Rettig, M. Nobody Reads Documentation. *Communications of the ACM*, 34, 7 (1991), 19-24.
 32. Shehan, E. and Edwards, W.K., Home Networking and HCI: What Hath God Wrought? In *Proc. of CHI 2007*, 547-556.
 33. Strauss, A. and Corbin, J. *Basics of qualitative research*. Sage Publications Newbury Park, Calif, 1990.
 34. Tolmie, P., Crabtree, A., Rodden, T., Greenhalgh, C. and Benford, S. Making the Home Network at Home: Digital Housekeeping. In *Proc. of ECSCW 2007*, 331-350.
 35. Torrey, C., McDonald, D.W., Schilit, B.N. and Bly, S. How-To Pages: Informal Systems of Expertise Sharing. In *Proc. of ECSCW 2007*, 391-410.
 36. Trigg, R.H. and Bødker, S. From implementation to design: tailoring and the emergence of systematization in CSCW. In *Proc. of CSCW 1994*, 45-54.
 37. Twidale, M.B. Over the Shoulder Learning: Supporting Brief Informal Learning. *Computer Supported Cooperative Work*, 14 (2005), 505-547.
 38. Wang, H.J., Platt, J., Chen, Y., Zhang, R. and Wang, Y.M. PeerPressure for automatic troubleshooting. In *Proc. of IMM 2004*, 398-399.
 39. Yang, J. and Edwards, W.K. ICEBox: Toward Easy-to-Use Home Networking In *Proc. of Interact 2007*, 197-210.