HUMAN-COMPUTER INTERACTION, 2000, Volume 15, pp. 323–351
Copyright © 2000, Lawrence Erlbaum Associates, Inc.

Troubles With the Internet: The Dynamics of Help at Home

Sara Kiesler, Bozena Zdaniuk, Vicki Lundmark, and **Robert Kraut**
Human–Computer Interaction Institute
Carnegie Mellon University

ABSTRACT

Despite advances in technology, nearly everyone experiences technical challenges using home computers and the Internet. In a field trial of household Internet usage, 89% of 93 families needed support from a computer help desk in the 1st year they used the Internet. However, usually only the most technically involved members of the family requested external technical support, and this behavior was associated with other computer-related behaviors in the household. We explore the process by which a family member with comparatively high technical skill or enthusiasm, often a teenager, becomes the family guru,

Sara Kiesler is Professor of Human–Computer Interaction at Carnegie Mellon University; she studies social and organizational aspects of technological change and communication systems. **Bozena Zdaniuk** is Data Management Coordinator for the Pittsburgh Mind Body Center at the University of Pittsburgh; she is a social psychologist working in health psychology and mental health. **Vicki Lundmark** is a sociologist and current Senior Research Scientist at the American Institutes for Research, Washington, DC; her research interests are equity, standards, and reform in math, science, and technology education. **Robert Kraut** is a social psychologist and Professor of Human–Computer Interaction and Social Psychology in the Human–Computer Interaction Institute, Carnegie Mellon University; he studies communication, collaboration, and social aspects of technology and technological change.

CONTENTS

makes external support requests, and becomes the person in the family to whom others turn for technical help. The family guru benefits from this role, influences the household's adoption of technology, and represents an important link between households and computer support professionals. The role also is a fascinating example of the evolution of intergeneration relationships.

1. INTRODUCTION

Although computer technology is practically ubiquitous, computers still pose substantial technical challenges to their users. The popularity of computer advice columns and training courses, the rise of the usability engineering profession, and the large budget allocated to computer support divisions attest to the complexities people encounter when using computers. Revenues of the problem resolution industry were nearly $1.4 billion in 1997 and could increase more than one third by 2002 (Hoffman, 1999). Even technical workers with advanced computer skills encounter usability problems when they try to learn new systems and programs (e.g., Barley, 1988; Orlikowski, 1996).

In the workplace, when employees need technical help, they often can turn to in-house professional technical staff or expert coworkers. At home, experts

and professionals might be unavailable. Customer support lines answer people's questions, but these services impose attention, monetary, or psychological costs that can discourage people from using them.

In this article, we examine the conditions and consequences of acquiring technical support at home. We draw from a longitudinal study of families' first experiences with the Internet (Kraut, Mukhopadhyay, Szczypula, & Kiesler, 2000; Kraut et al., 1998; Kraut, Scherlis, Mukhopadhyay, Manning, & Kiesler, 1996). This article uses data on technical problems and support that have not been presented in previous articles.

1.1. Setting

The data are from 93 Pittsburgh families (237 family members) who were provided with a computer and access to the Internet in 1995 and 1996. The goal of the project, called HomeNet, was to track residential Internet use for at least 1 year and assess its social impact. The first group in the sample contained 44 families with teenagers who began using the Internet at home in Spring 1995. A second group of 49 families with teenagers or with an adult on the board of a community development organization began using the Internet about 1 year later. Children younger than age 10 and uninterested family members were not included in the study.

The HomeNet project gave all families an Internet-ready package composed of a Macintosh computer with pre-installed Netscape home page and ClarisWorks Office software, a modem and extra telephone line, telephone and Internet service, personal e-mail accounts, training for family members, and regular hours of telephone and e-mail access to a help desk (Kraut et al., 1998; Kraut et al., 1996). Help desk staff included a professional technical director and Carnegie Mellon undergraduates with training in teaching basic computer skills. The help desk staff used beepers to receive calls and a program called Timbuktu (Netopia, Inc., 1995) to view and manipulate the participants' computers remotely. When necessary, help desk staff visited homes to diagnose problems and make repairs.

1.2. The Need for Technical Help

HomeNet's package was intended to reduce technical barriers to use of the Internet. Nonetheless, technical barriers remained. Over 70% of the households needed technical support to set up their computer and connect it to the Internet for the first time. Eighty-nine percent of the households requested technical support from the help desk staff during the 1st year of the trial. The technical challenges that family members encountered were numerous and diverse, ranging from not understanding that a modem and a telephone could

not be used simultaneously on the same line to needing help with setting up peer-to-peer chat (Figure 1).

Even though most families called the help desk at least once, fewer than one half of the individual family members called. At one extreme were those who stopped using the Internet without seeking external help. Others muddled through or sought and got help from friends, family, or books. A third group also relied heavily on help desk staff to solve their problems and help them learn new skills. Two participants called the help desk over 30 times in the 1st year of using the Internet.

1.3. Theoretical Analysis

Whom would we expect to seek external help? Research in organizational learning (Cohen & Levinthal, 1990), politics (Neuman, 1986), consumer behavior (Punj & Staelin, 1983), and the diffusion of innovations (Rogers, 1996) suggests that new knowledge is sought by, and accrues most to, those who already have a substantial amount of it. People who are more skilled in a domain are likely to realize what they do not know, have the confidence to stretch the limits of their expertise, and have an interest in learning more.

Analogies with the world of work might be useful in understanding who seeks and benefits from computer help in households. In the workplace, technical knowledge and advice typically flow into a work group through specialized information gate keepers (Allen, 1976; Constant, Sproull, & Kiesler, 1996; Tushman & Katz, 1982). Information gate keepers have distinctive personal attributes, such as having more seniority, competence, and organizational authority and centrality than those to whom they pass advice. They also have distinctive network positions—many social ties with people outside the group, from whom they import knowledge to the group, and many ties within the group, to whom they can pass on their knowledge. Acquiring new knowledge benefits the gate keeper and the group. Once gate keepers import information into the group, it travels through the group's preexisting social networks, especially communication links among friends (Allen, 1976) and those who occupy similar organizational niches or have similar personal attributes (e.g., Rogers, 1995).

If processes underlying the spread of technical knowledge within work groups also applies to the spread of technical knowledge within families, we would formulate the following hypotheses:

1. Individuals who initially are most motivated and skilled in using computers and the Internet will be most likely to seek external help.
2. The seeking and giving of technical advice will be a specialized role within the family.

Figure 1. **Examples of participants' computer and Internet problems reported to the help desk.**

Symptom Reported	Cause of Problem
E-mail freezes.	Never installed the modem. Did not know it was part of the computer.
Computer keeps dialing the Giant Eagle supermarket.	Typographical error in login script.
I cannot log in.	Caps Lock for password not noticed because password is hidden.
Error–39.	Buggy software.
Netscape disappeared.	User reformatted disk after advice from Apple's technical support line.
No application launch when clicked.	User closed windows instead of quitting program; program does not open a window if it is already running.
Modem will not dial.	Someone else was using the phone.
Modem will not connect after dialing.	Busy signals.
What is "add enclosure?"	Did not know e-mail could send documents.
Cannot connect to Elvis homepage.	Server at site busy or down.
Cannot find e-mail address.	Forgot address and did not set up an address book.
Cannot find Rabbit newsgroup.	Did not know how to use "match string" function. Then searched for "bunny" instead of "rabbit."
Cannot send e-mail to @oberon.pgh.vs.	The domain is .us, not .vs.
Still over quota despite erasing messages.	Deleted but did not purge messages.
Cannot get my MPEG videos to play.	Need to configure settings.
The launcher quits.	Disconnected aliases.
How do I save images for my Web page?	Need to obtain or download software.

Note. A complete list of logged help desk requests is provided at http://homenet.hcii.cs.cmu.edu/progress/helpdeskrequests.html or from the authors.

3. Outside help will spread through the entire household.
4. Advice will flow through the family along already existing contact patterns, as between children similar in age and sex, who spend time together. Parents tend to interact more with the child of their own sex (Bryant & Zick, 1996), and this trend tends to increase when children reach adolescence (Crouter, Manke, & McHale, 1995). Such interaction patterns may create more opportunity for exchanging computer help within same-sex parent–child pairs than within the opposite-sex pairs.
5. Transgenerational advice will flow from parent to child because parents have more seniority and more ties outside the family than children do. Previous research suggests that children are rarely the ones in a household to telephone for repair or service (Berk, 1985, Table 3.7).

6. Responsibility for transmitting computer technical skill will be sex segregated. In many work organizations, men predominate in technical jobs like programming, whereas women predominate in communication-oriented jobs like human resources.

Fay (1992) and Whitley (1997), in their literature reviews, report that in most studies, men exhibited more computer use and more positive attitudes than women. Many household tasks also are sex segregated (Berk, 1985; Bryant & Zick, 1996; White & Brinkerhoff, 1981). For instance, survey data show that men are much more likely than women to perform household repair tasks, whereas women are much more likely than men to repair clothing (Berk, 1985). Overall, in this view, adults would provide computer advice to children and other adults, children would provide advice to those of the same sex, and males would provide advice to others in the family.

Differences between work groups and families in composition, values, and activities suggest that Hypotheses 5 and 6 might be a too-simple application of the work group literature to families. The hypothesis that advice will flow from parent to children contradicts our everyday observations of the flow of outside information from children to parents in domains such as new music and clothing. In one study, adolescents' expertise and interest in stereo equipment led to their having significant impact on the family's idea to purchase a stereo and to its search and decision process (Beatty & Talpade, 1994).

These findings might not apply directly to the domain of computer technology. At least one study suggests that adolescents have had only modest influence on household decisions about purchasing computers, substantially less than their influence on decisions about more stereotypically child-oriented products—like bikes and children's magazines and records—and roughly equivalent to their influence in grocery shopping or the purchase of cable television (Foxman, Tansuhaj, & Ekstrom, 1989). Conversely, children may influence how families use a computer once it enters the home. Many families view computers as valuable because they enhance children's education and learning, and because computers are comparatively safe entertainment. Hence, families may foster children's spending considerable time with computers, and they may be especially encouraging of the development of technical computer skill by the children. Teenagers, in particular, have time and license to take on technical challenges and develop skills to master them. Many teens, in addition, are fascinated with computer technology. Compared with adults, they are very heavy users of computers and the Internet at home (Kraut et al., 1996). The likely consequence is that teenagers might be more important seekers of external computer help and sources of help within the family than one would expect based on their status and influence in other domains. This influence of teens might depend somewhat on the nature of family relationships. Teens' sometimes stormy relationships with their parents

could prevent them from effectively sharing the knowledge that they develop through use and experimentation. Teenagers may need to learn appropriate strategies of interaction if they are to influence their parents (see Palan & Wilkes, 1997).

Research on consumer behavior and family decision making also suggests that males in a household might not dominate the flow of computer advice. Many household decisions and tasks are shared (Davis, 1976; Davis & Rigaux, 1974). Even when a household task domain is the primary province of one person, it might not be dominated by the stereotypical person (Davis & Rigaux, 1974). For example, one study showed that the wife was the sole "family financial officer" in one third of the families, whereas the husband had that role in one fourth of the families (Ferber & Lee, 1974). In addition, family members' sex role orientations (e.g., Qualls, 1987) and their relative resources and "investments" in a task domain (e.g., Hempel, 1975) can influence which family member has the most influence.

In sum, we consider Hypotheses 5 and 6 to be exploratory and examine the sex and generational flow of technical help within the family in light of the contradictory implications of the work group and consumer literatures.

2. METHOD

Within the 93 families in the study, 237 members signed consent forms, were given e-mail accounts on the Internet, and logged on at least once. Measurements were collected as follows.

2.1. Requests for Support From the Help Desk

From the logs of telephone and e-mail requests for support, we tallied all contacts between members of the household and the help desk staff within the first 52 weeks of their household's acquiring Internet access.

2.2. Internet Usage

Automated probes on every person's Internet account identified each time the person logged on or off. To increase reliability, the computer-generated usage data were summed each week.[1] Our usage variable, connect hours, is an

1. Sometimes a member of the household used another member's Internet account without explicitly logging out and logging in again on that member's own account. To assess the degree of distortion that may have been introduced this way, we compared Internet and electronic mail logins. The results suggest that participants used the Internet under another family member's account in approximately 13.5% of the sessions.

average based on the total hours each week that participants were connected to the Internet during the period when they were still active. In other words, this variable reflects usage for the entire 1st year or until the time a participant stopped using the Internet altogether. We also created two companion variables to distinguish average weekly connect hours in the first and last 26 weeks of the 1st year. From the same automated logs of Internet connect hours, we also measured participants' "survival" online—the period from a participant's 1st week of use to that participant's last week of use, if fewer than 52 weeks.

2.3. Questionnaire Measures

All participants completed a pretest questionnaire before they received their computers and Internet service, and a posttest questionnaire 1 year after receipt.[2] Short questionnaires were administered occasionally during the trial and after the 1st year. The last variable we discuss—helping others in the family–is from one of the short questionnaires; the others are from the pretest and posttest questionnaires.

Computer Skill. A 5-item scale using 5-point Likert ratings on the pretest and posttest asked participants how much they agreed with the following statements: I am very skilled at using computers, I use computers almost every day, I am afraid of using a computer (reverse scored), using computers is fun, and I don't know much about using computers (reverse scored). Reliability of the scale is high (Cronbach's $\alpha = .85$).

Demographic Attributes. We created dummy variables to represent generation (adults vs. teens under age 19), sex (men vs. women), and race (Whites vs. minorities). These demographic attributes significantly predicted Internet usage in previous analyses with this sample, whereas household income and education did not (Kraut et al., 1996).

---

2. The first sample of families received the posttest 18 months later than the pretest; the second sample received the posttest 1 year later. Families who started the trial in 1995 (44 families, 136 participants) and families who started the trial in 1996 (49 families, 101 participants) differed significantly on two of the variables in our analyses. The 1995 sample used the Internet twice as much in their 1st year, on average, as the 1996 sample ($p < .01$), and they requested help more frequently ($p < .01$); significant differences remained when we restricted the analysis to adults. However, the groups did not show different results when testing the hypotheses. Therefore, we report findings for the entire sample together. In the analysis, each person's year starts when that person first logged on to the Internet.

Helping Others in the Family. In May 1997, we administered a short questionnaire to participants living at home at the time. We asked respondents to indicate the names of those in their family who helped them use the computer. The answers were transformed to create a score for each respondent representing how many family members the person helped. To control for family size, this score was divided by the number of family members who answered the question. Thus, the variable, giving help, reflects the proportion of family members who named the participant as a helper.

2.4. Home Interviews

The interviews from which we quote in this article were conducted in the homes of 25 participant families. Interviews with the family lasted approximately 3 hr. The interview covered family routines and interaction and included a tour of the house and the computer. Each member of the family who used the family computer took an interviewer through the person's usual interactions (starting up the computer, connecting to the Internet, reading e-mail, using the Web, etc.). Interviewers encouraged participants to talk about their experiences using the Internet.

3. RESULTS

Figure 2 provides simple descriptive statistics for the variables in the study. Of the nearly 50% of the sample who made requests of the help desk, about one half of those made one to three requests for external help; the remainder made four or more requests. Being a teenager, having more pretest computer skill, and using the Internet more were correlated positively with making help desk requests. In addition, making help desk requests was correlated with longer survival online; that is, those who contacted the help desk were more likely to still be using the Internet 12 months after first logging on. Individuals who gave more technical help to other family members also tended to have more pretest computer skill, use the Internet more, and survive longer online.

3.1. Predicting Who Requests External Technical Support

We used multiple-regression analysis to examine which variables uniquely predicted requests for technical help from the help desk, holding other variables constant. Figure 3 shows tests of Hypothesis 1 that pretest computer skill and Internet usage would predict the frequency of requests to the help desk. Because the frequency of help requests and hours of Internet use were not normally distributed, the analysis uses the log of the number of requests and the log of Internet usage to make the distribution more normal.

Figure 2. **Correlations among variables describing individual participants in their 1st year of using the Internet.**

Variables	Distribution[a]	1	2	3	4	5	6	7	8	9
1. Participant's generation (1 = adult, 0 = teen)	60% adults	—								
2. Participant's sex (1 = male, 0 = female)	45% males	–.02	—							
3. Participant's race (1 = White, 0 = non-White)	76% White	.01	.14**	—						
4. Household income of participant's family	*Mdn* = $42K	.04	.02	.23****	—					
5. Participant's pretest computer skill	*M* = 3.5 (1)	–.16**	.17**	.01	–.08	—				
6. Help desk requests made by participant	*M* = 2.6 (5.3)[b]	–.11*	.06	–.02	.02	.14**	—			
7. Help desk requests by other members of the participant's family	*M* = 4.8 (7.3)[b]	.00	–.11*	.04	.11*	–.13*	–.16*	—		
8. Number of others in family that the participant helped	*M* = .22 (.26)[c]	–.23***	.08	–.10	–.13*	.16**	.15**	–.30****	—	
9. Internet usage of participant (average weekly connect hours, log)	*M* = 2.8 (5.3)	–.20***	.06	.10	–.01	.24****	.37****	–.11*	.27****	—
10. Participant stopped using Internet (1 = stopped, 0 = active)	19.8% stopped	.01	–.026	–.12*	–.12*	–.07	–.19***	.06	–.09	–.23****

Note. $N = 237$.

[a]All means are based on untransformed scores. [b]Mean external technical support requests are calculated on all participants. Fifty-one percent of the sample ($n = 121$) never called the help desk. [c]Mean number of people in the family who asked participant for help divided by the number of family members who answered this question.

*$p < .10$. **$p < .05$. ***$p < .01$. ****$p < .001$.

Figure 3. **Standardized regression coefficients predicting the number of help desk support requests made by participants (logged).**

Independent Variables	Predicting Help Desk Requests (Coefficient)
Participant's generation (1 = adult, 0 = under 19)	.06
Participant's sex (1 = male, 0 = female)	–.02
Participant's race (1 = White, 0 = non-White)	–.06
Household income (in thousands) of participant's family	.03
Participant's pretest computer skill	–.05
Number help desk requests made by others in the participant's family	–.15*
Participant's Internet usage (average weekly connect hours, logged)	.50**
Adjusted R^2	.26

Note. $N = 237$.
*$p < .01$. **$p < .001$.

Figure 3 shows that Internet usage was the most important predictor of a person's help desk requests. People who used the Internet more made more help desk requests. In addition, individuals made more help desk requests in households where others did not make these requests. We discuss this negative relationship next. All other variables lacked statistical significance. Given that help desk requests were positively related to pretest skill and being a teenager (see Figure 2), but these relationships disappear after controlling for amount of Internet use, these findings suggest that the influence of prior technical skill and age on help seeking is mediated by ongoing involvement with the computer and the Internet. That is, teens and others who initially are skillful end up using the Internet more, which in turn leads them to be the household conduit for external technical information.

In home interviews we explored family members' motivations for asking or not asking for external technical support. Calling the help desk was rarely a person's first response to a problem. As reported in Franzke and McClard (1996), Internet "regulars" typically worked out problems themselves or asked other family members for help. One 18-year-old said,

> I'm basically a trial-and-error person. I learn a lot of things by myself. I don't like to sit down and listen to people telling me how to do stuff unless I know I have a problem in a certain area. (H)[3]

3. Names used in quotations have been changed. Quotations show uppercase character codes to denote the household.

When this teen had a problem she could not solve, she would ask her older brother for help: "At first I didn't know what I was doing. I'm saying, 'What's going on?' and I asked my brother. 'Oh, it's downloading; it's in the computer now; it's not on the home net.' It's like, oh OK."

People called the help desk when local resources did not suffice. This teen, for example, called the help desk when her brother was unavailable.

Our statistical analysis indicated that those who never called the help desk used the Internet less than those who did call for help. These participants were less interested in learning computer skills for their own sake ("I would leave it for later"). They hated waiting for help and alleviated their frustration by giving up:

> Mom: … there were times when I would just throw up my hands and get up and walk away.
> Daughter: Yeah, it would get me to the point where I would just [say] 'forget it.' (R)

Many participants who did not call for help could not diagnose their problems and did not have the vocabulary or background knowledge to discuss what went wrong with a technical person. An 18-year-old said, "I swear to God, every time I go to use the computer it doesn't want to work for me. It doesn't like me" (A). Compounding their lack of knowledge, some inexperienced users were too embarrassed to call on technical help, as is revealed in this exchange during a home interview:

> Q: Do you know what that is? [Interviewer points to hard drive icon on the desktop, which lacks a text label.]
> A: My granddaughter did that. I don't know why it went black.
> Q: Did you call the help desk?
> A: No, I thought we broke something. (M)

3.2. Specialization Within Families: Family Guru

We hypothesized (Hypothesis 2) that external help requests statistically would be concentrated within families, evidence of specialization. The negative association between participants' help desk calls and calls by others in the family is consistent with this hypothesis (Figure 2). Figure 2 also shows that those who requested external technical support from the help desk were also significantly more likely to give technical help to other family members than those who did not call for external help. The regression analysis reported in Figure 3 further supports the specialization hypothesis. It shows that control-

ling for a participant's demographics, pretest skill and Internet use, participants made fewer desk requests when others in their household made more requests.

In most of the families, one person made almost all contacts with the help desk during the year. On average, 1.2 persons called the help desk in families with 2 participants ($n = 34$); 1.4 persons called the help desk in families with 3 participants ($n = 23$); 1.6 persons called the help desk in families with 4 participants ($n = 10$); 1.5 called the help desk in families with 5 participants ($n = 6$), and 2 people called the help desk in the 2 families with 6 participants.

To further pursue the possibility that calling the help desk was part of a specialized role as family computer guru, we evaluated characteristics of the top help desk caller in each family. Figure 4 presents a household-level analysis in which we examine the attributes of the family member who called the help desk most often versus the rest of the family. Eighteen families with only a single Internet user are not included in this analysis. Figure 4 shows that the participants who called the help desk most frequently accounted for 38% of all family members but 80% of all calls. Those who made the most help desk calls also had significantly greater Internet usage than did others in the family and more, but not significantly more, pretrial computer skill. Also, the top external help requesters gave help to twice as many people in their family than did other family members.

The regression model in Figure 5 shows that being a teenager was a significant predictor of giving help to others in the family, even controlling for their greater use of the Internet and initial skill. Hence, compared to typical behavior in work organizations (Hypothesis 5), technical computer knowledge in these families flowed from less seniority to most seniority. At home, teenagers gave more help to other family members than did adults. Internet usage also was a significant additional predictor of helping others in the family: Those who used the Internet more gave more computer help to other family members.

3.3. Family Dynamics

To explore the interactions surrounding help giving in the household, we calculated the number of all possible pairs of participants within each family in which computer help could have been given. We grouped these pairs by generation and gender of the potential help giver and the potential help receiver. For each generation-by-sex group, we calculated the percentage of pairs in which help actually was given. This analysis is presented in Figure 6.

Within-generation helping characterized parents in our sample: They helped other adults in 30% of the adult–adult pairs, whereas they helped their teenage children in only 16% percent of all child–adult pairs ($z = 2.41$, $p < .10$).[5] However, cross-generation helping from children to parents character-

Figure 4. **Comparing participants who were the top help desk requester in their family with others in their family.**

Variables[a]	Top Help Desk Requester in Family[b]	Average for Other Participants in Family[c,d]	Difference Between Top Help Desk Requester and Others in Family
Average number of help desk requests made in 52 weeks	7.1 (7.8)	.5 (1.2)	$t(218) = 10.1$, $p < .001$
Average pretest computer skill	3.6 (1.0)	3.4 (1.0)	$t(218) = 1.4$, *ns*
Average pretest computer attitude	3.8 (0.6)	3.5 (0.7)	$t(218) = 2.4$, $p < .05$
Internet usage (average weekly connect hours)	5.6 (7.8)	1.7 (3.4)	$t(218) = 5.2$, $p < .001$
Ratio of teen help requesters to adult help requesters (in families with both teens and adults; $n = 58$ families, 179 individuals)	31/21 = 1.49	63/64 = .98	
Subset of families who completed special survey[e]	.34 (0.3)[f]	.16 (0.2)[g]	$t(159) = 4.4$, $p < .001$

Note. Eighteen single-participant families were excluded.

[a]Includes families having more than 1 participant ($n = 75$ families, 219 individuals). [b]$n = 70$. [c]Data in this column include those of 21 individuals (7 families) making no help desk requests during the year. [d]$n = 149$. [e]Comparisons are based on responses to a survey question answered in May 1997 by a subset of participants using the Internet. Number of others in family that the participant helped (based on the number of family members who indicated the participant as a helper divided by the number of family members who answered the survey). [f]$n = 54$. [g]$n = 107$.

ized the teen helpers. The teens helped other children in only 14% of all child–child pairs, whereas they helped adults in 38% of all child–adult pairs ($z = -3.39$, $p < .05$).[5] Contrasts of the direction of support in cross-generation pairs showed that teens were significantly more likely to give help to adults than adults were to give help to teens (38% vs. 16%; $z = -3.72$, $p < .05$).[4]

We had hypothesized that when help giving occurred, it would tend to follow within-sex paths of communication. Because we found that teens tended to help adults in the household, we then tested whether boys gave advice more to men than to women and whether girls gave advice more to women than to men. The results show that boys tended to give advice at similar rates to women (38% of all boy–woman pairs) and men (48% of all boy–man pairs; $z =$

4. The difference between proportions was tested using the two-sample binomial test of equal proportions (Marascuilo & Serlin, 1988, pp. 323–325) with the Dunn correction for multiple comparisons (pp. 371–374).

Figure 5. **Standardized regression coefficients predicting participants' help to more family members (weighted by number of family members).**

Independent Variables	Predicting Help Given to Other Family Members (Coefficient)
Participant's generation (1 = adult, 0 = under 19)	–.22**
Participant's sex (1 = male, 0 = female)	.12
Participant's race (1 = White, 0 = non-White)	–.11
Household income (in thousands) of participant's family	–.10
Participant's pretest computer skill	.06
Help others in family gave to family members	–.04
Participant's Internet usage (average weekly connect hours, logged)[a]	.15*
Adjusted R^2	.08

Note. $N = 167$.

[a]Average weekly connect hours were computed over the 4 months prior to the questionnaire that asked family members who helped them with computer problems.

*$p < .05$. **$p < .01$.

.65, *ns*). Girls, on the other hand, were more likely to give help to women (49% of all girl–woman pairs) than men (17% of all girl–man pairs), but this difference was of marginal statistical significance ($z = 2.66$, $p < .10$).[5]

Finally, Hypothesis 6 states that males would be more likely to give computer advice than females. The results indicate that men were not more likely than any other age or sex group to give computer help to other family members. The proportions presented in Figure 6 do suggest that boys gave more help than did other family members (36% for boys as compared to 26% for women, 23% for girls, and 20% for men). However, none of the pairwise comparisons were statistically significant.

In sum, our strongest finding was that advice and help flowed from teenagers to adults. This finding is consistent with observations during home interviews, in which we observed some serious dependence of parents on their children for help: "And I haven't done [insertion of audio clips] yet because I need Bobby [teenage son] to help me do that. … But ok, so now where were we, Bobby? Do I have to unconnect and reconnect? What do I do?" (41-year-old woman, B).

3.4. Impact of Help on the Helper

What were the consequences to a person of being the technical resource for a family? In Hypothesis 3 we proposed that making more help desk requests

Figure 6. **Percentage of potential helper–recipient pairs in which computer help was reported, sorted by age and sex of pairs.**

Received Help From Others in Family	Gave Help to Others in Family (%)				Total % Who Received Help
	Men	Women	Boys	Girls	
Men	10 (1/10)	28 (11/40)	48 (10/21)	17 (5/29)	27
Women	38 (15/40)	30 (3/10)	38 (8/21)	49 (16/33)	40
Boys	10 (2/21)	14 (3/21)	17 (2/12)	7 (1/15)	12
Girls	7 (2/29)	30 (10/33)	33 (5/15)	4 (1/24)	18
Total % who gave help	20	26	36	23	374

Note. Data came from 177 participants who completed a survey asking who helped them use the computer or Internet. Twenty-eight family members who were named as helpers but who did not complete the survey also are represented in the count of helpers above. The denominators for the proportions given are derived from the distribution of 374 possible helper–help recipient pairs, sorted by generation and sex. Anyone who was named as a helper by anyone else in the family is included and is counted as potentially a helper for the others who completed the questionnaire. For example, in a 3-person family, if a mother named her teenage son as helping her with the computer, then her son was potentially his father's helper and counted as such if the father completed the questionnaire. If the father named the son as a helper, then the son would be reflected twice in the table: once in the proportion of adult female recipients–teen male helpers and once in the proportion of adult male recipients–teen male helpers. Eighteen helpers were counted more than once.

and helping others in the family would lead to greater Internet usage and greater technical skill for the person who did so. We conducted regression analyses to evaluate the effects on a person of making help desk requests and helping others in the family. Because we have data collected at multiple time periods, we can see how getting and giving help at one time is associated with subsequent Internet use and skill, controlling for initial levels of use and skill. Figure 7 shows the results of this analysis. Model 1 predicts posttest skill and usage during the second half of the year from the demographic variables and initial levels of skill and usage during the first half of the year. Model 2 adds variables to the equations in Model 1 representing help desk requests and helping other family members. By controlling early usage and initial skill, the analysis is equivalent to an analysis of change in the outcomes, controlling for regression toward the mean and other artifacts (Cohen & Cohen, 1983).

Figure 7 reveals that making help desk calls in the first 6 months of the trial was associated with marginally less usage 6 months later ($p < .06$), but that making help desk calls in the second 6 months was strongly associated with increased usage in the second 6 months ($p < .001$). We believe the slight negative impact of earlier help desk calls on later usage reflects the mix of help desk call-

Figure 7. **Impact of making help desk requests and of helping others in the family on participants' subsequent Internet usage and skill, controlling for earlier usage and skill.**

	Predicting Participant's Internet Usage Weeks 27–52		Predicting Participant's Posttest Computer Skill	
Independent Variables	**Model 1 (Without Guru Variables)**	**Model 2 (With Guru Variables)**	**Model 1 (Without Guru Variables)**	**Model 2 (With Guru Variables)**
Participant's generation (1 = adult, 0 = under 19)	–.03	.00	–.11*	
Participant's sex (1 = male, 0 = female)	–.06	.11**	–.01	–.04
Participant's race (1 = White, 0 = non-White)	–.02	–.07	–.22****	–.21****
Household income (in thousands) of participant's family	.12***	.13**	.07	.06
Participant's Internet usage, Weeks 1–26 (average weekly connect hours, logged)	.76****	.75****		
Participant's pretest computer skill			.53****	.54****
Participant's number of help desk requests				
Weeks 1–26 (logged)		–.12*		.09
Weeks 27–52 (logged)		.22****		.07
Number of other family members who participant helped		.07		.07
Adjusted R^2	.56	.65	.33	.42
n	207	164	182	154

*$p < .10$. **$p < .05$. ***$p < .01$. ****$p < .001$.

ers in the first 6 months. One group, some "frustrated users," called the help desk but gave up trying and stopped using the Internet early (thus, their help desk calls predict lower usage 6 months later). The other group, the "Internet regulars" also called the help desk, kept calling, and kept using the Internet. Hence, the second 6 months of usage reflects participants who were more involved and committed, and who often called the help desk to help them do new tasks on the computer, not just to make repairs or fix bugs. Giving help to other household members did not predict future increases in Internet usage or technical skills (but, as we have seen, reflects Internet usage and skill).

Several other significant trends in the data shown in Figure 7 are worth noting. First, household income predicted increases in usage over the latter part of the year. Perhaps richer families could afford upgrades to their machines or software that would support more use. Second, teens and minority family members show highly significant gains relative to adults and Whites on the posttest computer skill measure. This result reflects an increasing skill gap favoring teens over adults in the household, and a narrowing difference between Whites and minorities, who began the field trial with slightly lower skill scores.

The statistical analyses do not show the process by which changes in usage or skill happened, or why calling for external support encouraged further Internet use. The home interviews suggest that help desk staff gave useful information to involved participants that went well beyond scheduling repairs and fixing simple errors. Some participants developed an ongoing relationship with help desk staff they knew by name, and whom they relied on for tips and "know how." In addition to using the help desk to get advice on connecting to the Internet and tracking down software bugs, they also used the help desk to expand their knowledge. They received advice on relatively simple tasks, like making a first Web page, to more complex tasks, like digitizing movies. Here is an example from an interview with a 19-year-old:

> Q: So you became competent in HTML?
> A: Yeah, I've gone in and done that because … You know Kevin [technical support staff]. He said it was real easy. You can go … I forget where it's at, find the source or whatever and copy from somebody else's [code], or just repeat the steps. And that's basically all I did (C).[5]

3.5. Impact of Help on Others in the Family

In Hypothesis 3 we predicted that the more a person made external help requests and gave technical help within the family, the higher would become the skills and Internet usage of other members of the family. Our analysis examines how one person's getting external help and giving help within the family was associated with other family members' later Internet usage and posttest computer skill. The participant in the household is the unit of analysis, inde-

5. More experienced participants were more likely to use e-mail to request technical support. (Only 20% of the participants used e-mail at least once to request support; all of this group used the Internet more than average.) The use of e-mail might have encouraged ongoing relationships with support staff because e-mail made it easy to correspond over time.

pendent variables are attributes of that participant (e.g., the participant's sex, age, or household income), and the dependent variables are the average weekly Internet usage in Weeks 27 to 52 and the average skill from the posttest questionnaire of other household members excluding the participant. As in the previous analysis, we control for initial levels of Internet use and skill. Figure 8 shows no evidence that an individual's asking questions of the help desk or giving help to more members of that individual's household increased the average usage or skill of the other household members.

The statistical analyses, however, which focus on how one individual's help behavior influenced others in the family, do not reveal the whole picture. Interviews suggest that the expertise developed by family gurus had mixed consequences for family members. The gurus' expertise kept the hardware and software running and helped other family members solve particular problems. At the same time, though, in the process of developing and exercising their expertise, the gurus monopolized the machines and personalized them, making them less attractive to other family members. The following excerpts from interviews illustrate some of the contradictory consequence of having a guru in the house.

Taking Charge

One way family gurus were helpful to others in the family was by taking responsibility for the introduction of the computer into the household, setting up the machine, organizing family files, and establishing routines for gaining access and using the Internet.

> Q: As I understand it, you have only one bookmark file for the family?
> A: No, we have separate ones. My brother is, like, director of the house. … I'm second in command. (H)

Gurus also mediated external technical support for others and encouraged and gave advice to others in the family. They championed use of the Internet and the acquisition of new technical skills:

> My niece is always trying to teach me how to use it. … You know so there's a lot of things I don't understand, or she shows me one time and I forget by the next time I have to use it. We tend to spend the weekends when she's home and stuff talking about what she's found, what I've found. [I ask] how you do this, and she shows me. Of course when she shows me, her fingers fly so fast I can't see it, I have to make her slow down, but I think it's brought [us] closer together. (52-year-old woman, W)

Figure 8. **Impact of a participant's making help desk requests and helping others in the family on other family members' subsequent Internet usage and skill.**

Variable	Predicting Other Family Members' Internet Usage Weeks 27–52		Predicting Other Family Members' Posttest Computer Skill	
	Model 1 (Without Guru Variables)	**Model 2 (With Guru Variables)**	**Model 1 (Without Guru Variables)**	**Model 2 (With Guru Variables)**
Helper's generation (1 = adult, 0 = under 19)	–.10**	–.11**	.01	–.10
Helper's sex (1 = male, 0 = female)	–.04	–.01	–.074	–.03
Helper's race (1 = White, 0 = non-White)	.08*	–.13**	–.17***	–.18***
Family's household income (in thousands)	.14***	.13***	.03	–.03
Internet usage of other family members, Weeks 1–26 (average weekly connect hours, logged)	.82****	.84****		
Pretest computer skill of other family members			.62****	.65****
Helper's desk requests				
Weeks 1–26 (logged)		–.03		–.13
Weeks 27–52 (logged)		.02		.11
Number of others whom the participant helped in the family		.00		–.06
Adjusted R^2	.65	.66	.41	.43
n	186	155	164	143

*$p < .10$. **$p < .05$. ***$p < .01$. ****$p < .001$.

Taking charge, however, could have some negative effects on others. Many gurus, by virtue of their being the most involved users of the Internet in their households, lobbied to have the computer installed in their rooms and monopolized the machine, making it inaccessible to others at convenient hours.

> [My husband] is really quite obsessive about it and … he checks, he logs on at 6:00 a.m. and it's the last thing he does at night. I get a crack at it periodically …. (50-year-old woman, F)

One teenage girl, explaining why she did not use the computer much anymore reported,

> I used it a lot more when I was in school. … It's not that I don't have an interest in using it, but … he's always on the computer. … [When my brother is] on the computer, it's like no, I want it now. We argue about it constantly …. (18-year-old girl, A)

For many of the household experts, especially the teenagers, taking charge of the computer meant customizing the machine in ways that made it less attractive to others. Teenagers installed flashy screen savers, moved files around, filed disks with huge music and image files, downloaded occasionally risky programs from the Internet, and created unusual user interaction preferences that claimed implicit ownership of the machine and confused other family members. Some downloaded programs emitted unpleasant noises when anyone used the computer. One teen, for example, changed the error sound, so that the machine spoke an expletive whenever someone made a mistake. Some even disassembled machines.

> Q: Then you were using [the computer] too?
> A: Yeah. Limited. Because it was in my son's bedroom and so he got to do everything, including taking it apart. (47-year-old male, H)

Good and Bad Teaching

Teen gurus were good and bad teachers. They were often close by when others needed their help, a great convenience:

> I can never get it back and that's one of the things that I'd have to ask Carla how to do it and she'd say "I've told you this how many times?" and she'd have to tell me again. (48-year-old woman, referring to her daughter, age 18)

But teens could be thoughtless.

> It seems that every time I have my [files] on here, I don't know what happens to them. I don't know if you can erase them and that's what my brother does to me, but like I had all my college ones on here, and I think he just erased most of them. (18-year-old girl, A)

And unsympathetic.

> And my Dad just doesn't know. It's tough to explain it to him because he's not used to it at all. Totally different generation. (18-year-old girl, H)

Authority Structure

The interdependencies between teenage gurus and others in the family had unexpected consequences in some families. Family members found themselves living with a teen who had become passionate about the computer and Internet. They felt fortunate that the teen was there to help family members when they had problems, fix "frozen" computers, make suggestions, and interpret what could seem an alien world of computing (Sproull, Kiesler, & Zubrow, 1984). Many parents initially had joined the trial because they believed it was "good for the kids." However, now the teen was becoming part of a new world and was adopting jargon, expertise, and interests that family members and friends did not always share. The social differences this change generated are reflected in the following interview with a teenage girl (H).

Q: So you think that using the Internet makes you stand out—makes you different from your friends?
A: A little bit. It makes me more knowledgeable when it comes to certain things.
Q: But they don't mind and you don't mind?
A: I mind teaching them everything. Like they don't know how to put in their names or whatever, plug in those little blocks. You have to click on them first. They don't know that. They just start typing and they're like, "well, what happened, my name didn't come up?" You have to type it, you have to click on it. It's like I'm on a certain page in my book and they're on page one and I can't deal with that.

Teens' technical expertise shifted intellectual authority in the family, as the same teen discussed:

Q: Is it like that with your father? If he were trying to use something and he couldn't figure it out and he asked you … ?
A: Sometimes if I'm not doing anything, I'm just like washing dishes or something, oh, he can't access something, I can help him. Sometimes [he says] "I know what I'm doing" [she lifts her eyebrows, indicating skepticism]. I don't know, maybe he gets upset that I know more about this than he does.
Q: Does he ask you very often?
A: Not very often.… He'll stumble across a few things now and then that he never knew they were there, and I'll show him.

Q: Is that fun for you?
A: A little bit. Gives me the upper hand.

The potential shift in authority was one explanation that some fathers gave for resisting help from their children, especially their daughters. This teen's experience with the Internet caused her to gain technical proficiency that her parents and siblings valued and admired, but her skill also created differences in outlook and interests to which everyone had to adjust. In many cases, however, parents' belief in the value of computers and computer skills overcame their reservations about these gaps. If they took action, it was often in the direction of trying to obtain more experience themselves, but often by themselves or with friends their own age.

4. DISCUSSION

Unlike most consumer products and services, computers require technical competence and know-how. Even today's user-friendly home computers are far more difficult to use than the average home appliance. When the washing machine stops working, it is easy to diagnose that the machine is at fault rather than the home's wiring, the soap, the clothing, or the user's behavior. When the computer stops working, diagnosis is much more difficult. We began this analysis to find out why people did or did not obtain available external technical support when they faced difficulties using their computer or the Internet. We wondered why those calling seemed to be the very people who knew the most, and why some people dropped out rather than called for help. We discovered that calling for external technical support is rooted in commitment to using the computer and the Internet, and that requesting support is part of a behavioral pattern characteristic of involved Internet users. These same involved users became a major source of technical support for other members of their families.

On the pretest, those with the most computer skill, confidence, or enthusiasm ultimately became the most involved users of the Internet. This involvement led to their making requests for external support to solve problems and accomplish new tasks, which in turn led to more Internet usage. Highly involved Internet users often became family gurus that others in the family relied on to mediate external help and to provide direct help and encouragement. Their help, however, had mixed results. Teens in the role of technical gate keeper could be especially uncomfortable to adults in the family who were unused to this experience. Typically, this same teenager was not the family member who called the electrician, fixed leaks, or repaired the dishwasher.

The flow of technical information within households we observed in this field trial shared some similarity with information flow in organizations. As in

organizations, the gate-keeping role tended to be specialized, with much of the technical information coming into the group through a small number of points of contact, who then redistributed this knowledge. As in organizations, the gate keepers tended to be the most technically competent in the group. However, the gate-keeping structure in families did not conform the structure of information distribution that has been attributed to large work organizations with a flow of technical information from more to less senior employees. Instead, computer expertise within families flowed informally from teens to adults, much as from children to immigrant parents, from graduate students to faculty, or from newly trained computer professionals to older programmers.

When we considered sex and generation in our analyses, we found some interesting complications. Men helped their wives but hardly anyone else in the family. The help-giving between mothers and daughters tended to be reciprocal, but that between sons and their fathers was not. There was some tendency for boys to serve as gurus more than girls, as would be expected based on their greater Internet usage (Kraut et al., 1996), but the differences were not significant. Many of the teen girls in this field trial considered themselves every bit as "nerdy" and computer skilled as boys.

In the families with teenagers, teens were usually the family members who lobbied for a PC and Internet access, and it was mainly for their teens' benefit that parents welcomed the computer (see Kraut et al., 1996). Many of the adults approached home computing with a highly instrumental orientation. The computer and Internet were innovations to get tasks done more efficiently—sending letters, writing papers, searching for product information, or even planning games. When the technology did not work as expected, it was a barrier between them and their goal. In contrast, many of the teens used computers and the Internet in a more playful manner. In addition to using the computer for communication, schoolwork, and games, mastering the computer was a goal in its own right. Teens had the time and the motivation to explore the Internet and develop new computer skills. Teens introduced new services to the household, downloaded programs, and served as the family's technical resource. Teen gurus, though, introduced a new, sometimes abrupt, dynamic into families unused to the teen's role at the interface of the family and the new world of the Internet. Teen gurus were admired for their abilities, and sometimes they were held in awe. Most of the parents were proud of their teens' computer accomplishments and were far more willing to tolerate hours spent before a computer screen than before a television screen.

4.1. Implications for Support Services

Our analysis has some implications for policymakers and designers and for those who provide Internet and computer support services. Our data suggest,

first, that current estimates of the demand for technical support assembled from professional support services underestimate the amount of technical support that people actually need. These estimates do not include informal help provided by friends and family and the help that people never seek out or get. Furthermore, if our data can be generalized, the calls to professional services probably represent a more sophisticated set of problems and users than would be represented by a random sample of users. The people who called the HomeNet help desk were the most technically involved in the household and many of their questions reflected more technical sophistication than the average family member had.

Although computers might be getting easier to use with each month, even today simply providing people with access to the Internet might not ensure that everyone can or will use this access. At this writing, our university help desk is thriving, which suggests that the computer is not yet an "appliance." We believe the industry needs to put more resources into assessing and improving usability, based on the experiences of the range of actual users. Given the centrality of teens in using the Internet and providing informal technical support, one strategy is to train high school students to give technical help more effectively within their families and communities. In this vein, an interesting project group in Austin, Texas gives low-income teens instruction and parts to build a computer. After teens build a computer for a nonprofit agency, they get to build one for their own household.[6] Similar projects with incentives and instruction to help others should benefit teens as well as others. And such programs would benefit of the computer industry, because of the strong links between skill, involvement, and helping others.

Our analysis has several limitations that could be addressed in future research. First, although in the home interviews we asked family members to "walk through" their use of the computer and the Internet, we were rarely able to observe the process of help seeking and help giving. Better measurement of family interactions would allow us to better understand the kinds of complaints, dissatisfactions, and assistance needs that led to different problem-solving strategies, including requests for family or external support. Second, we did not document the results of all help desk calls to know whether these calls led to solutions or further problems. For instance, we do not know if, or how often, repeat calls occurred because participants' problems were not resolved by the first request. More frequent requests for external support (ex-

6. See http://www.techreview.com/articles/oct97/chapman.html and http://www.utexas.edu/admin/opa/discovery/disc1998v15n2/disc_empower.html.

erted by those with more technical involvement) might be a consequence of higher standards for service, the pursuit of an unsolved problem, or both.[7]

4.2. Implications for Research on Technological Change

The last decade has seen a huge increase in the number of U.S. households using computers and the Internet. Estimates of U.S. households online as of 1999 range from one fourth to one third of households (e.g., U.S. Department of Commerce, 1999). Print, radio, telephone services, and television were previous technologies that brought the outside world into the household. The Internet continues and extends this phenomenon, giving individual family members easier ways to communicate and pursue their interests beyond the confines of home, neighborhood, and organization. Even though much research on diffusion of innovations and consumer behavior has examined how households adopt new technology, much less has examined how they domesticate it (Haddon & Silverstone, 1995), incorporating it into the ebb and flow of their daily lives. Future research needs to address this issue broadly. We focus here on the distinctive role of teenagers in the process of domestication.

Our study and industry estimates show that teenagers are leaders in taking advantage of these technological opportunities. Teens are among the first to adopt new, computer-based ways to communicate, learn, and be entertained, and the pace of technological change suggests that they will be in the forefront of change for some time to come.

Our study suggests that teens are helping families adjust to technological change and, at the same time, are carriers of social change. Meyrowitz (1984), in his analysis of the social impact of television, argued that television created a new household information system. Television, he said, helped to blur the boundaries between childhood and adulthood by exposing children to otherwise difficult to obtain information about the world, adult behavior, and social possibilities. The Internet is perhaps our own time's most important new household information system, and it might be contributing to a fur-

---

7. Our findings also bear on a theoretical issue in marketing science–how people respond "when things are not going well" (Withey & Cooper, 1989, p. 52). A. O. Hirschman's (1970) theory of voice and exit, which has been applied to many domains, is that consumers having difficulty with a product or service can exert either "voice" (i.e., complaining or requesting external support) or "exit" (i.e., abandoning the product or service). Hirschman proposed that a person's "loyalty" (commitment to a product or service) should increase the cost of exit and the benefits of voice (p. 98). This argument implies that requests for technical help should be interpreted as signs of interest and involvement in the product or service. This implication is consistent with our finding that those who used the Internet most were also more likely to exert voice—that is, to request assistance from the help desk.

ther blurring of childhood and adulthood. It is not just that teens on the Internet have a vast choice of Internet content and interactions. With the advent of the teenage guru, the child in the family plays a new role of child-as-technical-advisor, a role (given the high status of technical expertise in the United States) that confers on the teen authority and probably independence as well. Teens' expertise is an information resource, which, like money (Foxman et al., 1989a), could enhance their general influence in the family. With their teen guru, we observed that parents were likely to give in when there was contention over the use of the computer. Many were happy with the skills that their teens gained with nights and weekends spent at the screen, as long as the content was appropriate.

In future research, the social consequences of teenagers' expanding information environments should be studied further. For example, what changes occur in generational dynamics when children have more knowledge in some domains than their parents? How does the acquisition of technical expertise differentiate a person from that person's peers and from other family members? If there is a competency multiplier, the more technical person might grow farther apart intellectually from that person's peers and family even as that person helps them (Patterson, 1999)?

NOTES

Acknowledgments. We thank Debby Hindus and our anonymous reviewers for their helpful comments on the article.

Support. This research was supported by grants from Apple Computer, AT&T, Bell Atlantic, Bellcore, CNET, Hewlett Packard, Intel, Carnegie Mellon University's Information Networking Institute, Interval Research Corporation, Lotus Corporation, The Markle Foundation, the National Science Foundation (Grant IRI–9408271), the NPD Group, Nippon Telegraph and Telephone Corporation, Panasonic, the U.S. Postal Service, and US West.

Authors' Present Addresses. Sara Kiesler, Human–Computer Interaction Institute, Carnegie Mellon University, Pittsburgh, PA 15213. E-mail: kiesler@cs.cm.edu. Bozena Zdaniuk, University of Pittsburgh, Pittsburgh, PA 15213. E-mail: bozena+@pitt.edu. Vicki Lundmark, American Institutes for Research, 1000 Thomas Jefferson Street, Washington, DC, 20007. E-mail: vlundmark@air-dc-org. Robert Kraut, Human–Computer Interaction Institute, Carnegie Mellon University, Pittsburgh, PA 15213. E-mail: robert.kraut@cmu.edu.

HCI Editorial Record. First manuscript received November 9, 1999. Revision received June 5, 2000. Accepted by Jonathan Grudin. Final manuscript received July 7, 2000. — *Editor*

REFERENCES

Allen, T. (1977). *Managing the flow of technology.* Cambridge, MA: MIT Press.

Barley, S. R. (1988). The social construction of a machine: Ritual, superstition, magical thinking and other pragmatic responses to running a CT scanner. In M. Lock & D. R. Gordon (Eds.), *Biomedicine examined* (pp. 497–539). New York: Kluwer.

Beatty, S. E., & Talpade, S. (1994). Adolescent influence in family decision making: A replication with extension. *Journal of Consumer Research, 21,* 332–341.

Berk, S. F. (1985). *The gender factory: The appointment of work in American households.* New York: Plenum.

Berselli, B. (1997, MONTH DAY). When "Help" gives way to "HELP!" Top-level techies pick up the line. *Washington Post,* pp. A1, A7.

Bryant, W. K., & Zick, C. D. (1996). An examination of parent–child shared time. *Journal of Marriage and the Family, 58,* 227–237.

Cohen, W., & Levinthal, D. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly, X,* 128–152.

Constant, D., Sproull, L., & Kiesler, S. (1996). The kindness of strangers: On the usefulness of weak ties for technical advice. *Organization Science, 7,* 119–135.

Crouter, A. C., Manke, B. A., & McHale, S. M. (1995). The family context of gender intensification in early adolescence. *Child Development, 66,* 317–329.

Davis, H. L. (1976). Decision making within the household. *Journal of Consumer Research, 2,* 241–260.

Davis, H. L., & Rigaux, B. P. (1974). Perception of marital roles in decision processes. *Journal of Consumer Research, 1,* 51–62.

Ferber, R., & Lee, L. C. (1974). Husband-wife influence in family purchasing behavior. *Journal of Consumer Research, 1,* 43–50.

Foxman, E., Tansuhaj, P., & Ekstrom, K. (1989a). Adolescents' influence in family purchase decisions. *Journal of Business Research, 18,* 159–172.

Foxman, E., Tansuhaj, P., & Ekstrom, K. (1989b). Family members' perceptions of adolescents' influence in family decision making. *Journal of Consumer Research, 15,* 482–491.

Franzke, M., & McClard, A. (1996). Winona gets wired: Technical difficulties in the home. *Communications of the ACM, 39*(12), 64–66..

Haddon, L., & Silverstone, R. (1995). The Domestication of ICTs: Households, families, and technical change. In R. Mansell & R. Silverstone (Eds.), *Communication by design: The politics of information and communication technologies* (pp. XXX–XXX). New York: Oxford University Press.

Hempel, D. (1975). Family role structure and housing decisions. In M. J. Schlinger (Ed.), *Advances in consumer research* (Vol. 2, pp. 70–80). Ann Arbor, MI: Association for Consumer Research.

Hoffman, C. (1999). Technical support knowledge systems: An overview of the problem resolution industry [Webcast presentation]. (Available from International Data Corporation, 5 Spleen Street, Framingham, MA 01701)

Hoyman, M. (1987, September). Female participation in the informal economy: A neglected issue. *Annals of the American Academy of Political and Social Science,* 64–82.

Kay, R. (1992). An analysis of methods used to examine gender differences in computer-related behavior. *Journal of Educational Computing Research, 8,* 277–290.

Krackhardt, D., & Brass, D. (in press). Communications networks and organizations: A network approach. In H. L. Tosi (Ed.), *Extensions of the Environment/Organizations/Person Model: Volume II.* Greenwich, CT: JAI Press.

Kraut, R., Mukhopadhyay, T., Szczypula, J., Kiesler, S., & Scherlis, B. (2000). Information and communication: Alternative uses of the Internet in households. *Information Systems Research, 10,* 287–303.

Kraut, R., Patterson, M., Lundmark, V., Kiesler, S., Mukhopadhyay, T., & Scherlis, W. (1998). Internet paradox: A social technology that reduces social involvement and psychological well-being. *American Psychologist, 53,* 1017–1031.

Kraut, R., Scherlis, W., Mukhopadhyay, T., Manning, J., & Kiesler, S. (1996). The HomeNet field trial of residential Internet services. *Communications of the ACM, 39,* 55–65.

Lyons, W. E., & Lowery, D. (1989). Citizen responses to dissatisfaction in urban communities: A partial test of a general model. *Journal of Politics, 51,* 841–868.

Marascuilo, L. A., & Serlin, R. C. (1988). *Statistical methods for the social and behavioral sciences.* New York: Freeman.

Meyrowitz, J. (1985). *No sense of place: The impact of electronic media on social behavior.* New York: Oxford University Press.

Netopia, Inc. (1995). *Timbuktu user's manual.* Alameda, CA: Author.

Neuman, R. (1986). *The paradox of mass politics: knowledge and opinion in the American electorate.* Cambridge, MA: Harvard Press.

Orlikowski, W. J. (1996). Improvising organizational transformation over time: A situated change perspective. *Information Systems Research, 7,* 63–92.

Palen, K. M., & Wilkes, R. E. (1997). Adolescent–parent interaction in family decision making. *Journal of Consumer Research, 24,* 159–169.

Patterson, M. (1999). *Social distancing effects of interest in computers and other expert avocations.* Unpublished manuscript, Carnegie Mellon University, Pittsburgh, PA.

Punj, G., & Staelin, R. (1983). A model of consumer information search behavior for new automobiles. *Journal of Consumer Research, 9,* 366–380.

Qualls, W. J. (1987). Household decision behavior: The impact of husbands' and wifes' sex role orientation. *Journal of Consumer Research, 14,* 264–279.

Sproull, L., Kiesler, S., & Zubrow, D. (1984). Encountering an alien culture. *Journal of Social Issues, 40,* 31–48.

Tushman, M. L. (1977). Special boundary roles in the innovation process. *Administrative Science Quarterly, 22,* 587–605.

U.S. Census Bureau. (1998). *Household and family characteristics: March 1998* (Update, pp. 20–515, summary tables). Retrieved MONTH DAY, YEAR from the World Wide Web: http://www.census.gov/population/www/socdemo/hh-fam-sum98tab.html

U.S. Department of Commerce. (1999). *Falling through the Net: Defining the digital divide.* Washington, DC: Author.

White, L. K., & Brinkerhoff, D. B. (1981). The sexual division of labor: Evidence from childhood. *Social Forces, 60,* 170–181.

Whitley, Jr., B. E. (1997). Gender differences in computer-related attitudes and behaviors: A meta-analysis. *Computers in Human Behavior, 13*(1), 1–22.