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# Interventionist Methods for Studying Technology in the Home

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**Abstract**

As technologies in the home move from single-user standalone devices to interconnected technologies requiring network connectivity, end users at times may need to setup, configure, and maintain the home network, as well as devices that connect to the network. This paper outlines challenges of studying the usability of networked technologies, and describes our experiences with using breaching experiments to study technology usage and maintenance practices in homes.

**Author Keywords**

breaching experiments, infrastructure, home networks

**ACM Classification Keywords**

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

**Introduction**

Although human-computer interaction research traditionally has focused on the user experience at the *interface level*, decisions made with respect to lower-level technologies can greatly affect user experience. As technologies in the home move from single-user, standalone devices to networked technologies, end users setting up, maintaining, and troubleshooting information technologies may now interact not just with end user devices but also with infrastructures (e.g.

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home networks) that have no clean and clear interfaces for use.

Yet studying how users interact with these distributed, interfaceless devices can be challenging. Even more so, studying how users react to and recover from infrastructural level technology problems calls for new methodological approaches. Traditional techniques for assessing usability may not be appropriate when used in the context of studying infrastructures—such as the devices and interconnections required to “make a home network work” [5]. This paper first outlines the challenges of existing methods used to study technologies in home settings, and then describe our experiences using breaching methods to learn more about technology setup, usage, and maintenance practices. It concludes with a discussion of both the advantages as well as ethical quandaries of using this powerful approach to studying home technology usage.

### **Challenges of Home Infrastructure Research**

The bulk of research on home networks and in-home troubleshooting of technologies have used householder self-reports to understand computing usage and maintenance practices in homes [1, 3, 5, 6, 10]. Although interviews probing “critical incidents” are a low-cost and quick method to learn about technology problems and maintenance practices, they run the risk of shallow recollections and biased results. Specifically, two issues come to play here: one is *timing*, and the second is *identifying relevant incidents*.

First, let’s discuss *identifying relevant incidents*. As the complexity of the home computing ecosystem increases, so too does the number of stakeholders who can and do have influence on the ongoing usability of a

home’s technologies. Prior research finds that technical upkeep of home computing devices and infrastructure technologies is often collaborative [9, 11, 12, 15]. Critical incidents—such as changes that another householder may have quietly made to a computer, media server, or firewall—are not always notable to end users being interviewed as “critical” items. Getting a more accurate picture can require triangulation across stakeholders within and beyond a given home.

Next, let’s discuss *timing*. If there is a large time gap between the incident and the interview, memories of specific steps taken to troubleshoot a problem may not be accurately remembered. Ideally, researchers could time interviews such that they happen soon after a “critical incident” occurs, but it can be challenging to predict the timing of incidents, which can occur at any time.<sup>1</sup>

There are a number of ways to address these limitations. Depending on the research questions at hand, one could use lab experiments to setup situations for observing troubleshooting practices. The tradeoff, however, is the absence of richness that occurs in real-life settings with respect to troubleshooting and configuring technologies; networked home infrastructures involve a number of stakeholders, and the knowledge and ability to make changes is spread

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<sup>1</sup> Note, however, that holidays and the beginning of the school year are two times of the year that one could expect increases in problems, due to holiday gift giving, school-related purchases, and the arrival or departure of family members who perform digital housekeeping or troubleshooting services. This could also be an ideal time to do ethnographic observations of setup and troubleshooting.

### Example Breaches From [9]

Ex 1: Your wireless access point (the piece of equipment that lets you use wireless internet) will let you do something called “MAC address filtering.” 1. Look online or ask someone you know what MAC address filtering is. 2. Once you know what it is, change the settings on your wireless router so that it uses MAC address filtering. Even if it's difficult, remember to try to do this task yourself!

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

across these stakeholders, creating problems of dependencies.

To overcome these limitations, some researchers have used techniques resembling diary studies or experience sampling; in these studies, householders interacted with networked technologies in their homes, and then shortly afterward reported their experiences to a research team. However, this work is largely limited to studying the experiences of individuals attempting device installation [2, 7] or learning about the purpose and functionality of a newly installed research device or device suite [13, 14]. Less research examines the integration of new items into an existing technology ecosystem, with a notable exception being the *homework* initiative in the UK; this effort placed specialized access points into home networks to increase visibility and intelligibility of household network activity.

I'd argue that many of the “interesting” problems with the home technology maintenance require a more subtle approach. For instance, studying household coordination and divisions of labor unfolding over time and space isn't something easily addressed in a laboratory environment. To close this gap, breaching experiments—researcher-driven disruptions put into the home technology ecosystem—can serve as a vital component in the home technology research methods toolbox.

### Breaching Experiments as HCI Method

In my own work studying coordination and troubleshooting of home computing technologies, I used breaching experiments to study technology help practices. Breaching experiments, emerging from the

ethnomethodological tradition, are research studies in which the researcher deliberately disrupts the ordinary character of day-to-day life in order to understand social norms and reactions.

I'm certainly not the first person to discuss the role of breaching in technology research. For instance, Tolmie and Crabtree discussed how home technology research deployments of any sort could be considered breaching experiments [13] in their analysis of Gaver's Video Window [4]. Discussions of breaching, however, typically cast it as a problem rather than a useful tool. In contrast, I argue that breaching experiments have a valid and useful place in studies of existing technology infrastructure-related practices in domestic settings.

In my own work, breaching experiments were used to understand existing infrastructures in the home in ways that are not easily accessible via previously used methods. Specifically, householders were asked to interact with home technological infrastructures in ways that potentially disrupted the social norms of the home in order to understand the nature of home computing usage and maintenance practices. For example, *all* members of a home enrolled in the study were asked to participate in a series of home technology installation, maintenance, and teaching practices (called “homework assignments”), even if they did not normally do so outside of the confines of the study. Shifting responsibilities, adding new equipment to the home technology ecosystem, and reconfiguring existing equipment allowed for deeper understandings of labor divisions in homes. For instance, people who lived in houses where an occupant had a small business relying on Internet connectivity were far more cautious about installing new devices or making network configuration

changes that could interrupt business workflow. It also provided fodder for discussion about power dynamics between more and less skilled family members. Fuller descriptions of this technique and its results can be found in [9].

There are other complementary projects studying householder orientations toward networked technologies in the home. For instance, the *Homework* initiative in the UK placed customized access points into the home network to provide functionality to visualize data flow and household network activity in meaningful ways [8]. As a new component placed in home networks, the *Homework* access point could be considered in itself a breaching experiment. Yet breaching doesn't *need* to be a researcher-created artifact; depending on the research questions to be answered, off-the-shelf consumer electronics devices, or changes in who does certain routine household tasks, can be just as useful but require less upfront development time and cost.

### **Ethics and Challenges of Breaching**

Breaching, however, is not without challenges. At what point does disruption of household practices become unethical? Human subjects regulations clearly specify that researchers have the responsibility to provide information about the risks and benefits of a study, to ensure that participation is voluntary rather than coerced, and to protect participants from physical, mental, and emotional harm. Nevertheless, operationalizing these requirements in the context of a home technology study is less clear-cut.

Like any researcher, I aimed to conduct ethical research. Participants were informed at the beginning

of the study of what they would be doing, that participation was voluntary, and that it was possible that they could inflict temporary damage on their home networks. To address these risks, if participants were stuck on a given task, a member of the research team would make an emergency house call to cooperatively troubleshoot the issue and, in a sense, "talk the participant down from the ledge." For the most part, this approach worked well. In fact, in some cases, through the study activities, participants were empowered by the realization that they were more technically capable than they had imagined. However, the hairy problem remains. To get the participants to *try* certain tasks, compensation for each week of the study was tied to completion of a certain number of the "homework assignments." Was this an unethical choice? Published guidelines on research ethics don't provide clarity on these issues. In retrospect, it is possible that my study was manipulative, particularly given that the majority of my participants were seeking additional income due to poor economic conditions at the time in which the study was conducted. As a community, we have a responsibility going forward to establish standards for when and where breaching should and shouldn't be used.

### **Conclusions**

In summary, traditional human-computer interaction techniques may fall short when studying user experience of infrastructure technologies. Breaching experiments and other interventionist methods, while introducing some level of artificialness into the activities completed by participants, may provide researchers with richer accounts of technology complexity and the social norms surrounding the use and maintenance of technologies in the home. Yet they

also come with unresolved ethics challenges, which the human-computer interaction research community must resolve.

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