

Human-Data Interaction through Design with Smart Home Cameras

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The complex sensory and data mining features of smart home cameras engender new, sensitive data interactions that entangle larger debates about privacy, power, and control. Aligned with these concerns, we present an ongoing investigation surrounding discursive aspects of peoples' relationships with cameras in the home. With a total of fifteen individuals from nine different households across the US, we designed a series of speculative and discursive activities about smart home cameras to probe behaviors and interactions as cultural probes and research instruments. As such, cameras in the home reveal multifaceted interactions through considering camera footage as a form of personal data. In this paper, we discuss examples from this ongoing research pertaining to the core tenets of human-data interaction (legibility, agency, and negotiability) to critically explore the adoption of always-on recording technology.

CCS CONCEPTS • Human-centered computing → Empirical studies in interaction design

Additional Keywords and Phrases: Home, cameras, Internet of Things (IoT), Human-Data Interaction, speculative

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1 INTRODUCTION

The home is an unwieldy site for data interaction and collection. While new domestic Internet of Things (IoT) technologies like smart home cameras offer users advanced audio, video, and cloud storage features for managing one's security, such modernized conveniences also reveal problematic areas for contending with issues of privacy and power [4].

Particularly, smart home security cameras have amplified data uncertainties as they fuel black-boxed facial recognition algorithms, with connections to police agencies and potentialities for data breaches [3,5]. Byzantine networks of data flow are often obscured from smart home camera users themselves, presenting a textured site of inquiry for HDI. In this position paper, we draw on our ongoing research examining smart home cameras to illustrate how this adoption of technology in and around the home expands and complicates HDI's core tenets.

2 TENETS OF HUMAN DATA INTERACTION (HDI) IN SMART HOME CAMERA DESIGN

From 2020 to 2021, we conducted a remote research investigation to probe discussions about privacy and personal data with always-on camera sensors in domestic scenarios. In this study, a total of fifteen individuals from nine different households across the US participated in a series of six weekly activities with cameras in their home, inspired by speculative enactments [1] and material speculation [6]. Filming videos of themselves, household members, and their environments, the nature of these enactments vacillated between playfulness and seriousness, all the while scrutinizing different functional aspects of smart home cameras. Our research and analysis focuses on how people interact with the multidimensional forms of data as footage, collected by cameras in the home. Below, we discuss examples from the study with respect to the three tenets of HDI: data legibility, negotiability, and agency.

Participants commented on the various ways that they grappled with the illegibility of their data ownership and privacy. Many participants were aware of some form of "cloud storage" with their home camera videos, but the details—and most important the privacy and security implications of this—were opaque to most. Due to this, some expressed concerned speculations about the possibility of a third-party having access to their private footage, along with a general sense of futility about how to confront this.

While the concept of external data access and storage at an institutional level was not particularly legible to participants, they constructed their own internal rules around privacy concerning filming and staging their videos for their weekly activities. When choosing how to frame or record scenarios for their activities, participants displayed a considerable amount of agency in reflecting on their videos from the perspective of an 'imagined audience.' Participants reflected on how their footage (the data collected in this case) might be perceived or even misconstrued by neighbors, the general public, or the research team themselves. To this effect, participants were conscious to exclude infants from the camera view, hide personally-identifiable items such as addresses on packages, and experiment with different camera angles to mask how much of their face and body was revealed on camera.

In HDI, negotiability refers to the ways in which individuals "trade off data access for functionality" [2]. Through engaging in our speculative enactments with cameras, participants constructed everyday negotiations of data access and etiquette in reflecting on their video capturing process. Participants crafted their own assumed societal contracts and norms around filming and collecting footage of themselves, guests, and other individuals' through smart home cameras. Smart home cameras necessitate data interactions at various levels connoting different power imbalances as they capture audio and video footage by users and non-primary users (such as passersby or gig workers who may be captured on camera), embedded in legal frameworks concerning data privacy and access with companies and authorities.

To this effect, participants weighed different levels of data negotiations with smart home cameras, articulating distinct camera norms around them and their cohabitants, and potential guests inside and outside

the home (friends, delivery workers, solicitors). For example, reflecting on how they negotiated their own data privacy, participants selected different areas in the home where they felt were more 'public' and were thus more acceptable to set an always-on recording device in the area. Some, however, adopted the approach that always being recorded was simply a given, especially for their need to maintain security. This sentiment was similarly extended when considering norms around the privacy of guests or non-primary individuals. Here, smart home camera users exchanged data about themselves and other individuals in exchange for wider security functions with their home cameras, such as sending videos of strangers outside their home to camera companies to help train their facial recognition software.

Through everyday interactions with cameras in the home, we have thus observed how participants speculate about interacting with data. Although companies render concepts such as cloud storage and external data access as deliberately opaque to users, participants enacted their own agency over their footage through curatorial decisions on framing and contextualizing their videos. Overall, our contribution highlights the interplay between these three tenets of HDI at an empirical level through the analysis of smart home cameras. For IoT researchers and designers, these examples are especially poignant for understanding users' informal epistemes of data interactions, even amidst the illegibility of systems as we see inscribed in smart home cameras (such as cloud computing, AI, and facial recognition technology).

3 GOALS

As someone beginning my scholarship in this area, I hope to build a community with and learn from other researchers in data ethics and HDI. I am especially eager for conversations about responsibility and sensitive data approaches in considering the impacts and potential harms of ubiquitous recording devices. By participating in this workshop, I also hope to expand our understanding of HDI challenges from individual and institutional levels. As our research presents a highly individualized perspective of how people manage and negotiate their data, we hope to also deconstruct hierarchies between individual, institutional, and legislative efforts for data conscientiousness.

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