Supplemental Materials for:

Anna Lenhart, Sunyup Park, Michael Zimmer and Jessica Vitak. 2023. "You Shouldn't Need to Share Your Data": Perceived Privacy Risks and Mitigation Strategies Among Privacy-Conscious Smart Home Power Users. In *Proceedings of the ACM on Human-Computer Interaction,* Vol. 7, CSCW2, Article 247 (October 2023), 31 pages, https://doi.org/10.1145/3610038

In this study, we ran 10 focus groups with 32 people we label as "privacy-conscious smart home power users." In these supplemental materials, we share documents used in data collection and analysis.

This file includes:

- Recruitment text and groups targeted for recruitment
- Screener survey
- Focus group protocol
- Final codebook

Recruitment Text

Message 1 (posted to Reddit and Facebook): Hi there, I'm a researcher at [university] and I study how our privacy is affected by new technologies. We're currently recruiting folks who use smart home devices for virtual focus groups to talk about how they use devices in their homes, the types of data these devices collect and share, and how we can design tools to better visualize this data and provide consumers with more control over their data. If you're interested in participating, find more information and a link to a short screener survey here: [survey link]. Thanks!

- Reddit
    - r/smarthome
    - r/smarthings
    - r/homeautomation
    - r/alexa
    - r/homekit)
- Facebook Groups
    - Amazon Echo Alexa Help & Smart Home Help
    - Smart Home Products
    - Home Assistant
    - Smart Home Enthusiasts
    - Amazon Echo Alexa Help & Smart Home Help
    - Amazon Alexa Users Group
    - Everything HomeKit

Message 2 (posted to Authors 3 & 4's Twitter accounts): Do you use smart home devices (speakers, thermostats, cameras, etc.)? If so, we want to talk to you! We're running focus groups this summer to explore how to help smart home users view and understand data from these devices. See [survey link] for more details & pls share!

Screener Survey

Participants who clicked through the recruitment message link were taken to Qualtrics and viewed a consent page, which outlined details of the study. Once they consented & confirmed they were at least 18 years old, they were asked the following questions.

First, we have some basic questions about your background.

[Q1] I am:
Female identifying
Male identifying
Non-binary / non-conforming
Prefer to self-describe: [option to enter text]
Prefer to not answer

[Q2] My current age (in years) [open ended]

[Q3] How would you describe yourself? (Check all that apply)
American Indian or Alaska Native
Black or African American
East Asian
Multiracial
Middle Eastern
Native Hawaiian or other Pacific Islander
South Asian
White
Another race (please specify) [option to enter text]
Prefer to not answer

[Q4] Please indicate the highest level of education you have completed.
Less than high school
High school degree
Trade/technical/vocational training
Associate's degree
Bachelor's degree
Master's degree
Post-graduate degree (PhD, JD, MD, etc.)
Prefer to not answer

[Q5] Which of the following best describes your current living situation?
I live in a space I own
I live in a space I rent
I live in another type of space [please describe]

[Q6] Which of the following describes your current living situation? [check all that apply]
I live by myself
I live with one or more friends
I live with a partner/spouse
I live with my children
I live with my parents or other family members
Another living arrangement? Please describe: [option to enter text]

[Q7] Including yourself, how many adults reside in your home? [enter 1 if you live by yourself]

[Q8] How many children (under age 18) live in your home? [enter 0 if there are no children in the home]

[Q9] Indicate the extent to which you agree or disagree with the following statements.
[Response options: 1=Strongly Disagree, 7=Strongly Agree]
In general, I believe privacy is important.
In today's world, privacy does not exist anymore.
I'm concerned that "smart" devices collect too much personal information.
I'm confident in my ability to control how much personal information I share online and through my phone.

[new page]

[Q10] We're especially interested in the types of "smart" devices you have in your home. By smart devices we refer to home appliances and furniture that you connect to the internet and can be controlled by your voice, an app on your phone, or another device.
From this list, please check off all that you own/currently use.
Smart speakers (e.g., Amazon Alexa, Google Home)
Smart thermostat (e.g., Google Nest)
Smart vacuum (e.g., newer versions of the Roomba)
Smart doorbell (e.g., Ring)
Security cameras
Smart lighting (e.g., Philips Hue)
Smart blinds
Smart TV
Smart refrigerators
Smart microwaves
Smart door locks
Smart sensors (e.g., that detect movement or sound)
Something else not listed? [option to enter text]
None of these

[Q11] Do you connect multiple smart home devices together? For example, you can link your smart speaker with smart lights, so you can control it via your smartphone app or voice-controlled devices such as smart speakers?
Yes
No

[Q12] Think back to when you have purchased smart home technologies, and check all the statements that apply.
I usually make decisions to purchase a smart device on my own.
I talk with other people in my home before purchasing a smart device.
Someone else in my home usually makes decisions about purchasing smart devices.
I have received one or more smart devices as gifts.
Someone outside my home makes decisions about purchasing smart devices (e.g., apartments with devices pre-installed).

[Q13] Now think about how these technologies are used in your home. Which statements best apply to your current situation? Check all that apply.
I fully manage how smart devices are used in my home.
I share management of smart devices with other people in my home (e.g., a partner).
Someone else in my home fully manages how smart devices are used.
Someone outside my home makes decisions about managing smart devices (e.g., apartment management).

[Q14] To what extent do you agree or disagree with the following statements?
[Response options: 1=Strongly Disagree, 7=Strongly Agree]
I am comfortable using most of the smart devices in my home.
Smart devices in my home have acted in unexpected ways.
Smart devices in my home sometimes respond incorrectly to a prompt.
I am uncomfortable with the amount of data my smart home devices collect.
Smart devices in my home have made my life easier.
I get frustrated with the smart devices in my home.
I'm confident I could explain to someone else how my smart devices work.

[Q15] Are there any smart devices you previously used but have since stopped using? Yes
(please describe) [option to enter text]
No

[Q16] Have you changed how you interact with any of your smart home devices over time (e.g., changed settings, no longer use it for certain purposes)?
Yes (please describe) [option to enter text]
No

[Q17] Are there any types of smart devices you wouldn't use or would hesitate to use?
Yes (please describe) [option to enter text]
No
I'm not sure

[new page]
We will be running 60-minute focus group sessions over Zoom later this summer. All participants will receive a $30 gift card. If you'd like to be considered for participation in a focus group, please list your name and email below.
Name:
Email:

[new page]
In thanks for your participation, we will have a raffle for a $75 gift card. If you'd like to be entered, please add your email address below. The winner will be notified within two weeks of the survey closing. Email:

[end of survey]

Focus Group Protocol

Thank you for joining us today. The format of this session is a focus group. If you've never done one of these before, I have a set of questions I'd like to open up to discussion, but there's no formal method for answering. I encourage everyone to share their thoughts. My role is merely to facilitate the conversation; you all will be guiding it.

We're here today to talk about smart home technologies. This includes a wide range of devices, from smart thermostats and smart speakers, to connected TVs, fridges, vacuums, doorbells, security systems, toys, and more. We want to build a tool that helps consumers understand the types of data that are collected and used by these smart technologies, so the main goal of today's session is to learn from you about what information you think is important and what factors would make a tool like this useful to you.

We'll be recording the session today, but I want to assure you that whatever is being shared in this room today stays with us, and anything we use from this conversation will not be connected to your real name. That said, please treat this session as confidential and do not share things we discussed today with others. This session is scheduled to last 60 minutes. Does anyone have questions before we start?

[Open to questions]

As a warm-up, let's talk about what types of smart technologies you use in your home. Can we go around the group and each of you share your name and then walk us through a normal day and **talk about the various devices you interact with and how you might use them. What do you like the most about them? What do you dislike about them?**

[Discussion]

For those of you who share your home with other people, smart devices may pose an interesting challenge because it's hard to "opt out" of using them. So we're curious, how do you make decisions about buying and using smart devices?
- Prompt (if needed): Is there one person who is "in charge" of managing these devices?
- Prompt (if needed): Do you have discussions with other household members before buying or setting up a device?

[Discussion]

Because you're using a range of devices, we can talk about building up an ecosystem of smart technologies that talk to each other and potentially share data. Thinking about that, one thing we want to hear more about is how you decide whether to connect smart devices to each other.
- Prompt (if needed): Do any of you struggle with the technical aspects of setting up and using

these devices? Can you share an example of how that affected your decision on how to use a device?

- Prompt (if needed): Are there any devices you don't want to connect? Why?

[Discussion]

We're also interested in hearing about any times you've maybe been concerned about data being collected or transmitted by your devices. Are you ever worried about data being collected by one of your devices, or things a smart device might have "overheard" or collected without you knowing?

[Discussion; finish by X:30]

Okay, we're going to spend the rest of the hour doing some design thinking activities. We're interested in ways to better share smart device data with consumers, and we want to think creatively about what that could look like.

[Design Thinking: Part 1]
We want you to brainstorm all the types of data smart devices might collect about you and how you prioritize control over this data. Each of you have been assigned a Jamboard (virtual whiteboard) page. For the next few minutes list each type of data you can think of that is sent or received by each of your smart home devices (one per sticky note)

Place each sticky note on the grid provided. The grid has two axes capturing how sensitive a piece of data is to you and how much you want to be able to monitor and control that piece of data. So along the horizontal axis, place data you consider to be most sensitive on the right and along the vertical axis, place the data you would like to have more visualization or control over in the top half.

[Answer questions, give them three minutes to do this, then summarize the themes briefly and ask if anyone has things to add; finish by X:45]

[Design Thinking: Part 2]
Thanks so much for your engagement in these activities. To wrap up, I'd like you to get your thoughts on what types of features you would want in a tool that helps you visualize the data your smart devices collect and share. I realize this is kind of an abstract question, there are no wrong answers. You'll have three minutes to jot down as many feature ideas as you can come up with, then we can talk them through.

[Facilitator note: As all the sticky notes are posted we can start to look for trends/themes that emerge and group them, this often leads to a more fruitful discussion. If short on time, skip the sticky noting part and just ask them to discuss features as a group.]

Wrap-up: *thank everyone for attending and let them know about getting gift cards and that we'll share results once this is written up.*

Final Code Book

Code Name	Code Description
Benefits of Devices	Comments about benefits of devices / ecosystem.
Bystanders	Comments about other people's interaction with devices and/or data collected about people other than the primary person(s) who sets up/manages devices. This includes references to children, other family members, visitors, and/or renters.
Data Concerns	Broad or specific concerns about data collected by IoT devices. Don't use for privacy concerns that don't specifically reference data from devices. Don't use for cases where a person expresses a lack of concern (that should get data sensitivity).
Data Sensitivity	Comments about how they view certain types of data as more or less sensitive (e.g., I don't care if people know the temperature in my house).
Decision-Making & Use	Comments about how they decide to buy and use specific devices, the types of research they do before buying or regarding integration, and devices/brands they won't use. This includes references to the role that other household members play in decision making.
Design Features	Comments about the types of things participants would want to better manage their smart home data, or things they like in their existing systems. Also use for references to features they like in their current management tools.
Device & Network Management	Examples of steps participants take to manage their devices, ways they modify/tweak the device or ecosystem, including reviewing data, ensuring a device is only set up on the local network, automations, limiting access, etc.
Devices Used	Descriptions of the devices they're using in their home and any routines they've set up. Only use on first reference to device. Also use for a specific reason they started using smart home devices.
Drawbacks of Devices	Comments about limitations of devices they use or things they don't like about devices or find frustrating (e.g., talking about devices not integrating well into their ecosystem).
Good Quote	Excerpt that could be used in paper write-up; comment that's indicative of broader trends in data.
Privacy Comments	Participant explicitly mentions privacy when talking about their use of smart home technology or more broadly.
Security Comments	Participant explicitly mentions data security when talking about their use of smart home technology or more broadly. Don't use if people mention using tech like cameras to resolve safety concerns.
Unsure	Not sure what code to apply—excerpts with these codes will be discussed by the group.