

Data Privacy and Security with Smart Home Devices

Understanding the concerns of smart home device users

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INTRODUCTION

“How might we improve transparency and privacy for smart home device applications for people who are hesitant to purchase new technology?”

Our current network of devices, electronics, and digital necessities has developed a deep, interconnected system that can automatically transfer and collect information through wireless means. Moreover, the existence of hardware such as the Amazon Alexa, Echo Dot, Google Home, Nest, Home Pod, and others allows a deeper implementation of such relations. Regardless of their intended purpose, the capabilities of such devices has expanded the numerous personal, business and marketing information that can be contrived from their production and usage.

PROBLEM

With the rise of artificial intelligence, smart devices, and expectations for technological fluency, there's a large stigma regarding the behind-the-scenes, including data collection and the breaching of privacy. Our goal is to analyze these observations to improve and understand transparency between technology and users. In doing so, we can also implement UI changes to inform individuals about data collection and security, and increase user literacy with technology.

LOCATION

The majority of smart devices exist across the United States and are located within users' residences. From both a national and global scale, they reside in locations with Wi-Fi access and internet services.



SIGNIFICANCE

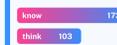
A balance exists between the potential in personalization and an intrusion of privacy. In an effort to create a more personalized and friendly experience, the individual must give more of their personal preferences to the unknown; whether this decision is offered upfront or hidden behind the UI, this is the paradox that generates uncertainty and skepticism within the public eye. Exploring what options are available to share, and how companies utilize said options shared to them, grants greater understanding in the benefits or ramifications of customization.

QUANTITATIVE DATA ANALYSIS

LANGUAGE PROCESSING

MAIN KEYWORDS

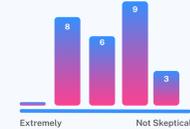
The results of our language processing reveal that smart home device users state that they “know” about the device, while non-users tend to assume, abundantly using words like “think” when responding to questions.



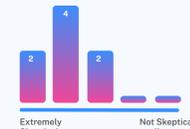
MENTAL MODELS

“Representations of systems and environments derived from experience” When we use a product or interact with a system, we subconsciously remember patterns and create mental models of how we think the product or system is supposed to work. We used our mental models about the usefulness of smart home device interfaces and hardware to inform our research decisions and solutions. After conducting data analysis, we learned our mental models aligned to other young students.

YOUNGER GENERATION (17-24)



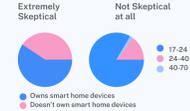
OLDER GENERATION (40-70)



OVERALL RESULTS



Analyzing our data results and categorizing people's skepticism about technology by age group, we discovered that people who are older tended to be more skeptical about smart home devices than college students, regardless of if they owned one themselves; these results corroborated our initial assumptions.



QUALITATIVE DATA ANALYSIS

INTERVIEW PROFILES AND KEY INSIGHTS

Field Expert
Elena Deng
Amazon Alexa Team
Joined 1 year ago

Student users

Paradox

Collecting information allows for further customization of smart home devices.

“In order to have a more personalized experience, computers and companies need to build a profile around you” (Joseph)

Lack of Privacy Concern

Young people don't think they are saying important information that needs to be hidden.

“Maybe I just don't think I have enough valuable information for people to steal” (Joseph)

“There are so many other people using these devices, why would other people target me? Conversations are nothing to hide” (Jonathan)

Smart Home Device Usages

Smart Home Devices are primarily used for convenience. Most people are not familiar with the app and think it is counterproductive.

“It's not really that much effort for me, but it's for my parents. They're usually doing something or going in and out of the kitchen. So for them, it's pretty useful” (Michael)

“My smart home devices are hooked up to lights, so it's convenient” (Qiaochu)

“The point of an Alexa is to not look at your screen. If you're going to build an app to do all of these things, it goes against the entire point of the Alexa” (Joseph)

Transparency Issues

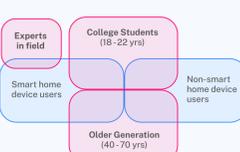
People don't know how their privacy is dealt in smart home devices. Information on data security and transparency exists, but it is difficult to find.

“Officially, no, I've heard like rumors and stories, but actually, I have no official information myself” (Michael)

“I feel like the information is available if you search for it, but it's not I wouldn't say transparent, I'd say it is a lot of effort to find the information” (Michael)

RESEARCH METHODS

AUDIENCE



QUALITATIVE

• Audio recorded interviews: Transcribed into Otter.ai.
• Used language data visualizer to detect keywords and commonly recurring terms
• Located in a private and quiet space for clear video recording
• Recorded responses to interview questions to identify common trends and synthesize insights

QUANTITATIVE

• Google Form Survey: Sent out an initial form for participant feedback
• Identified whether participants use smart home devices based on their demographics
• Asked whether or not they would be able to participate in a recorded interview
• Asked surface level questions on data security/privacy

MICRO
Primary research interviews asking individuals about their personal experiences

INTERMEDIATE
Google form sent out to various people including different demographics

MACRO
Discover secondary research and data from various online sources about the issue

STAKEHOLDERS



- 1 Designers responsible for current UI
- 2 Programmers responsible for software
- 3 Engineers responsible for hardware and structure
- 4 Potential Buyers of Smart Home Devices

Primary
Secondary
Tertiary

PERSONAS

“Profiles for archetypal users to meet the needs of the audience.” Information for our user profiles was derived from our stakeholder interviews. With these profiles in mind, we developed our user centered solutions.

USER CENTERED SOLUTION 1

Increase awareness about existing smart home device features regarding data security and privacy

Customers usually only use 15% of the Alexa capabilities. — Elena Deng
“It's very hidden: you don't know about it unless you know about it. — Joseph”



Existing Security Features

- When onboarding, users can choose what they want Alexa to know, they can turn cameras off, tell Alexa their gender, and other personal information.
- At any time, users can turn on the mute button, and Alexa can't hear them anymore.
- Alexa isn't listening to the user when they don't say the wake word.
- Users can delete, view, or hear all voice recordings.
- Users can ask why Alexa responded in a particular way: “Alexa, why did you do that?”

Overview

Current consumers only use a fraction of the features that smart home devices provide and are often unaware of existing software that protects data security and privacy. Many interviewees stated that it was “difficult to tell what the device is collecting about [them]” (Justin). This issue could be resolved through highlighting these hidden privacy features with corporations broadcasting and publicizing them on a wider scale.

Implementation

Increasing awareness to these features could be achieved in numerous ways including specifically discussing privacy with the user during onboarding, illustrating these features on the Alexa homepage, incorporating a new section for privacy on the app, and integrating transparent interactions such as “Alexa, why did you do that?” into advertisements and publicity videos. This would allow everyone to easily access and understand what information about Alexa collects and ask why certain recommendations are being made.

USER CENTERED SOLUTION 2

Redesign UI to improve app clarity, organization, and information flow for the user

“The information [on the app] can be condensed...it's hard to find information...it's low key a maze — Elena Deng”

There are lots of ways for Alexa to be customizable, that it's not achieving right now — Elena Deng

Implementation Components

Drawing from the interviewees personal experiences with smart home devices as well as our secondary research, the first component we would address is minimizing the overlap between what is displayed on the device and what is on the app; we found that repetition is unnecessary and confusing. We would also focus on condensing information on the app, to make it easy to understand for all users.

“For the first three years, there were a lot of features that were difficult to use and led to me ignoring certain features on the app.” — Justin. The UI design was consistently referred to as clunky, which made users less inclined to interact with it.

- Other features that would enhance the users experience and comfort level include:
- Name customization for multiple Alexa devices in the same area
 - Ability to view the user profile Alexa has built on them
 - Specific UI page about company data usage

Increasing Accessibility

A common issue mentioned during interviews was that the current language processing interface often doesn't recognize people's foreign accents. After contacting Elena, we learned that Amazon is working to improve this interface which would improve accessibility for many. Specifically, Amazon held a recent design conference discussing how Alexa doesn't recognize black accents, hosted by their department on diversity and inclusion.

Learning curve isn't that hard... for the older generation to talk to their phones, language is the biggest thing. Can't recognize accents — Joseph

ASSUMPTIONS & WEAKNESSES

Research

- Would benefit from a larger sample size of the older generation
- Conduct interviews with subjects beyond Carnegie Mellon University students
- Google Form restructured to better present and organize data

Solutions

- People who are skeptical of digital security and privacy will trust the information about smart home device policies
- Younger people are typically more receptive to changing technology
- People use the Alexa/smart home device mobile application

OCCAM'S RAZOR

“The simplest solution is often the most effective” Aligning with this principle, our solutions focus on developing simple and often overlooked solutions to addressing data privacy including accessibility and awareness to the issue. Simple solutions are more likely to be implementable for both corporations and users.

