Data Privacy Communications in Smart Home Technology for Older Adults: Evaluation, User Attitudes and Concerns, and Design Implications

by

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ABSTRACT

As the global population continues to age, there is an increasing need for smart home technology that supports older adults in living independently. There is evidence that technology today is capable of automating and carrying out various tasks in the home. However, the adoption of such technology by older adults has been limited, beyond usability and accessibility challenges, due to data privacy and security concerns. Through the evaluation of privacy policies and user agreements of smart home devices from the perspective of the aging population, and a collection of the beliefs and attitudes older adults share about data privacy and smart home technology adoption, this thesis provides a set of guidelines for improving the design of privacy communications that have been evaluated through in-person interviews that companies operating in the smart home technology space can use. These guidelines can be used to inform the way that companies convey content related to data privacy, and also to develop and design devices that are customized to the requirements of older adults which will facilitate a larger adoption of such technology among this population. Ultimately, the hope is that informed adoption of technology will contribute to the overall well-being and quality of life of older adults by enabling them to age-in-place.

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To Older Adults all over the world, those who have not yet gained the trust of technology, and are forced to move out of their homes because they cannot support them any longer - this thesis is dedicated to you. I hope this changes and that the future holds less instances of privacy trade-offs, and allows everyone who is in a similar situation as you to experience informed and comfortable adoption of smart home technology that will help make your home *'ageless'* and allow you to have the option to *age-in-place*.

AUTHOR BIOGRAPHY

Manasi's interest in design was sparked when she volunteered to be a scribe for students with dyslexia while she was in high school. Their struggle with a learning disability that was obviously at odds with conventional learning methods made it clear to Manasi that there was a systemic education problem to be solved, and that the needs for inclusivity and accessibility apply to all kinds of abilities. Her research revealed a stark disparity between how average members of society view the world versus the extreme users – and most initiatives or projects tend to focus on average users. During her early career before enrolling in a graduate school program, Manasi learned about the hurdles a corporation faces in its pursuit of inclusively-designed products, and she worked with a government hospital in India toward creating a new way to receive informed consent from patients and their families before they have surgical medical procedures. She believes that it is possible to create solutions that are relevant to one group without excluding another and ultimately ignoring accessibility requirements, and her MITidm education has trained her to be a well-rounded professional ready to tackle these challenges. While at MIT, she did her thesis and research at the MIT AgeLab with a focus on making different aspects of data privacy more accessible and comprehensible to older adults in particular. Manasi hopes that informed adoption of technology will encourage more older adults to use and feel comfortable around the technology that can help them to age-in-place.

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01.

Introduction

1.1 An Aging Population

The population of older adults throughout the world is increasing at an unprecedented rate; developed nations will soon have a majority of their populations above the age of 60, with developing nations following closely behind. Older adults currently above the age of 65 account for 16% of the population in the United States (54.1 million), and this number is expected to increase by 36% to 94.7 million by 2060 (Ortman et al., 2014); further, the population of older adults over the age of 85 is expected to increase by 115% from 6.6 million to 14.4 million by 2040. In 2020, 27% of older adults lived alone, and as the population of older adults continues to expand, it is expected that this number will rise in tandem. The number of older adults who live alone - 42% - is greatest among women who are 75 and older.[1]

According to a survey conducted by AARP in 2021, 77% of adults over 50 in the United States want to age in place.[2] A third of these adults said that in order to do so they would have to make some modifications to their current home; 48% mentioned the need for smart home devices and 61% mentioned the need for emergency response systems to support their desire to age in place. More generally, the question of whether we are equipped to support this population to age in place arises.

1.2 Smart home technology

As older adults age, they require the ability either to perform or obtain support for various tasks, such as cooking, cleaning, shopping for groceries, managing their health, and staying in touch with loved ones, in order to maintain their independence. Some of these tasks may include cleaning the house or apartment at

[1]https://acl.gov/sites/default/files/aging%20and%20Disability%20In%20America/2020Profileolderamericans.final_.pdf

[2] AARP. (2021, February). Home and Community Preferences Survey. AARP. https://www.aarp.org/home-family/your-home/info-2021/home-and-community-preferences-survey.html

regular intervals, cooking meals on a daily basis, attending to the door, ordering or being able to procure groceries on a regular basis, monitoring health, procuring medicines that are required on a regular basis, and communicating with their family and loved ones of their health status. For many, the ability to do these tasks deteriorates with age, and, as a result, a lot of older adults make the decision to age in community living, and some move into assisted living or nursing homes. The technology that can be deployed in the homes we have today has the potential to help older adults age in place independently, and also help caregivers providing care to older adults aging in communities (for example, doing things like automating tasks like monitoring movements, switching the lights on and off, controlling temperature, installing a smart coffee maker, setting reminders for medicines, remotely controlling the blinds, etc.). As the population ages, technologies like these offer the possibility of providing support for older adults to continue to live independently.

1.3 Technology adoption among older adults

If we really want smart home technologies to support older adults' aging in place, we need to ensure that older adults are open to adopting such technology. Yet previous research in the field of technology adoption among older adults, especially smart home technology, has been limited. The Pew Research Center (2019) reported that older adults on average use technologies less than younger adults. Kim and Choudhary (2020) published a study that concluded older adults adopted a technology mainly if they saw a direct benefit, whereas younger adults were open to adoption of new technologies for the purpose of exploration. Anderson and Perrin (2017) discuss general barriers to adoption, including lack of familiarity with technology, low confidence in the ability of older adults to learn a new technology, lack of comfort, and physical challenge.[3] Pireh et al. highlighted the low adoption rates of smart technology among older adults despite the various enhancements and introduction of new assistive services that have particularly been designed for older adults.[2] They also discussed various factors around acceptance of smart home technology and concluded through their research that technology designed for seniors is expected have higher adoption rates if the researchers working on the development: "(1) provide interfaces via smart devices to control and configure the monitoring system with feedback for the user, (2) include various sensors/devices to architect a smart home solution in a way that is easy to integrate in daily life, and (3) define policies about data ownership." [3]

1.4 Data privacy as an adoption barrier

1.4.1 Data privacy documents

Privacy is important and is protected by various legal and cultural systems around the world; it is considered as a fundamental human right in many countries (Article 17, ICCPR, 1992; Article 12, United Nations Declaration of Human Rights, 1942). The term 'privacy' refers to the right individuals have that allows them to control access to their personal information, financial information, activities they do daily, tracking and location information, as well as what they do in their private life safe and away from

[3] Pew Research Center. (2017). Barriers to adoption and attitudes towards technology. Retrieved from https://www.pewresearch.org/internet/2017/05/17/barriers-to-adoption-and-attitudes-towards-technology/

outsiders (other individuals, companies, third-parties, etc.) - in essence, all of their personal data. Data privacy laws and policies regulate how data are collected, stored, used, destroyed, and under what circumstances (if any) shared with third parties. The companies and organizations that handle data are also required to protect it, especially any data that are personal or confidential, as unauthorized access to the data can lead to fraud and identity theft, and there are multiple implications for a person if sensitive medical and financial data fall in the hands of the wrong individuals.

The European Union (EU) is at the forefront of the data protection movement through its incorporation of the General Data Protection Regulation (GDPR). The GDPR gives users and customers more control over what kind of data are collected and how their data are used; companies and organizations are also required to inform users and consumers what they do with the data collected and are mandated by law to inform users if a data breach takes place at any point. This law applies to each and every website that operates in the EU region. The Data Privacy Impact Assessment (DPIA), which is part of an EU regulation, required companies and organizations to fill out detailed forms that provide a detailed assessment and enquiry into the reasoning behind the collection of the data from customers and users.

The United States lacks such broad privacy laws, and as such, users and consumers are required often to consent for each technology, application (app) or device to what data is collected and how the data might be used or shared. As a result of the number of technologies and apps consumers have, the number of times an individual is asked to sign or consent to privacy policies is increasing; many Americans are asked to agree to terms and conditions as often as once per day (Pew Research Center, 2015). These privacy policies are typically lengthy, and language uses a lot of legal jargon that is usually difficult for a person without a legal background to understand and comprehend.

1.4.2 Data collection in smart home devices

A recent report shows that data privacy is a top concern of American households, with 29% of the population being concerned about data privacy.[4] If older adults are expected to adopt technology that might make their lives easier and enable them to live independently for longer, the technologies will have to collect various kinds of data. A lot of this data may be very personal, which many older adults may be uncomfortable consenting to and not want the technology to collect. However, a lot of older adults end up agreeing to provide this data to the technology companies in order to be able to use the technology. This leads to the requirement for investigating the various kinds of data smart home devices can potentially collect, and whether older adults consenting to the use of this technology are really aware of the various kinds of data these devices might be collecting. There is a need to investigate if consent to the collection of this data in order to use a device means that the users are aware of all the data that is being collected and if the consent is being taken in a meaningful way.

1.5 Human-centered design for data privacy communications

Findings from previous studies around the challenges and impact of comprehension of privacy policies suggest that if the policies are presented in a simple and prominent way, it does not guarantee

[4] https://today.yougov.com/topics/technology/articles-reports/2021/06/09/american-concern-smart-appliances

comprehension (Korunovska et al., 2020). The authors conclude that there is a need for design solutions that simplify and highlight the thread secondary use of personal data can cause. We need to be able to control the use of such data in a user-friendly way, and, in general, governments may need to have stricter regulations around privacy and the secondary use of personal data.

Human-centered design puts the needs of the user at the forefront. Privacy communications by companies are not optimally designed for the users to read. Companies providing services and products have to notify users or customers of the practices they follow that involve the customer and user data. For successful onboarding and the ability to use these products and services, the customer or user has to consent positively to this notification. The documents that carry out this notice and consent steps are often referred to as a domain that only lawyers and policy-makers can understand and make sense of (Auxier et al., 2019)[5, 6]; there is no seat at the table for designers, creative technologists, and other professionals who might put the user and their needs first.

One element of the concept of data privacy is having control over the collection and use of your personal information. Being able to control the collection and use of one's data through different smart home technologies involves receiving and reviewing documents like privacy policies, user agreements, and documents highlighting the terms and conditions of use of certain services and devices. If users are expected to go through these communications and comprehend the content presented in them, there need to be more efforts to ensure these documents are designed for the users and not merely a check-the-box for the legal teams of various technology companies.

Users will likely take time and experience to get familiarized and become accepting of new formats. Hence, even though most users prefer short and concise privacy policies, some users may actually prefer privacy policies that are lengthy because they are perceived as more thorough and secure and a format they are familiar with compared to other alternatives. Repeated use of such alternative and short privacy policies, however, and efforts to educate users may eventually lead to users trusting the new privacy communications (Kununka et al., 2017).

Because user agreements and privacy policies are so important for governing what data are collected and how they are used, **this thesis will explore the following key questions:**

- Through evaluation and careful examination of the content in privacy policies and user agreements, how might we prove the need for exploring better ways of presenting these to users?
- What do users think of the privacy policies and user agreements made by companies and their importance? How do users generally read these documents?

[5] Auxier, B., Rainie, L., Anderson, M., Perrin, A., Kumar, M., & Turner, E. (2019). Americans' attitudes and experiences with privacy policies and laws. Pew Research Center. Retrieved from https://www.pewresearch.org/internet/2019/11/15/americans-attitudes-and-experiences-with-privacy-policies-and-laws/

[6] Dellinger, AJ. (2018, April 17). Privacy policies are too complicated to understand, new analysis confirms. Mic. Retrieved from https://www.mic.com/impact/privacy-policies-are-too-complicated-to-understand-new-analysis-confirms-18002848

- How might we design privacy communications that ensure comprehension and prioritize user understanding?

To address these questions, Chapter 2 will provide a literature review of the various work happening around smart home technologies, technology adoption for older adults, and the data privacy space. Chapter 3 will focus on evaluating privacy policies and user agreements of various smart home devices from the perspective of older adults. Chapter 4 provides an in-depth look at the beliefs and attitudes of older adults about technology adoption and data privacy through virtual and in-person focus groups. Chapter 5 tests prototypes of various designs of privacy policies and summarizes users' preferences, as well as highlighting the need for redesigning privacy communications. Chapter 6 highlights the key results from the thesis and lays out the discussion points as well as different opportunities for future work in this space. The Appendix provides supplementary information or materials related to the content discussed in the main thesis.

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6. Dellinger, AJ. (2018, April 17). Privacy policies are too complicated to understand, new analysis confirms. Mic. Retrieved from https://www.mic.com/impact/privacy-policies-are-too-complicated-to-understand-new-analysis-confirms-18002848

02.

Context

2.1 Introduction

Learning how to use a technology, the complexity of the technology, and poor user experience are some of the key reasons for low technology adoption rates among older adults (AARP Research, 2023). In addition to these, data privacy concerns around smart home technologies have been a significant reason that prevents older adults from adopting them. Smart home technologies offer multiple benefits that could potentially allow users to live in their homes with greater convenience. Benefits include multiple accessibility features, such as being able to control devices in the home through voice commands, or unlocking the door for a family member or friend without going down the stairs through a smart lock, to name a few. Using smart home devices often requires some kind of hub (including smart speakers, which are often considered as hubs). Smartphones and tablets also act as enablers of various smart home services; installing a company's application on a smartphone, tablet or laptop is very often a requirement in order to sign up for the device, to operate it, and to control the privacy settings. The Pew Research Center (January 2022) published a survey that highlighted that the number of older adults owning and using smart home devices has increased over the last few years. With smartphones and tablets as key technologies needed to operate smart devices, the survey notes there was a steep increase in the number of older adults who own a smartphone, from 13% in 2012 to 61% in 2021, although this still means that 39% of older adults do not own a smartphone, limiting to some degree their access and ability to use and benefit from many smart home technologies.

2.2 Smart home technology space

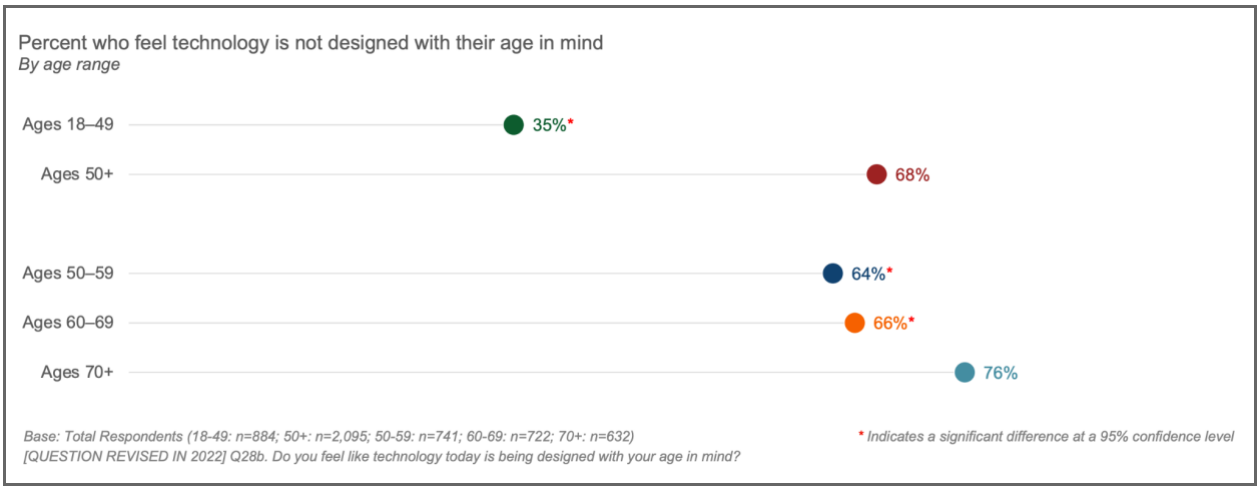
A recent study from Statista (December 2022) revealed that in the United States, the revenue generated from smart home technology is expected to have an annual growth rate of 10.22%, which results in a projected market volume of $51.19bn by 2027.[7] In 2022, 43.8% of households in the United States had at least one smart home device; this number is expected to rise to 68.6% by 2027. This study, however, did not include people over the age of 65, who may be expected to reap significant benefits from these technologies over the coming decades.

Adoption of technology in general depends in part on how open people are about a particular concept or idea, and how excited they are to try it out. The Diffusion of Innovation (DOI) theory by Rogers (1962) lays some of the initial principles of adoption. Older adults are often late adopters or laggers (considered as part of the mainstream market) when it comes to trying out new technology, Moore (1991) describes marketing efforts to sell high-tech products to the mainstream market with the concept of 'Crossing the Chasm'. This way of describing the technology adoption curve has gained popularity over the past couple of decades, and we distinctly see that unless the technology is specifically designed for older adults, they will not likely be in the early adopter's phase. It is important to note that even technologies that are specifically designed for older adults, they have not been adopted widely due to various gaps in addressing what older adults actually need and are looking for when interacting with new technologies (Lee and Maher, 2021). According to a survey conducted by AARP in 2023, only 20% of those above the age of 70 own a smart home technology, and a majority (76%) believe that the technology was designed without considering the needs of those above the age of 70. In contrast, 68% of those within the 18-49 age group believe that technology they use is designed keeping their needs in mind (see Figure 1).[8] Some of the top reasons for low rates of adoption among older adults are the technology is too complex, having a poor user experience or being difficult for older people to use, and difficulty learning how to use the technology, emphasizing the need for more training (AARP Research, 2023).

Figure 1 – Technology Trends Among Midlife and Older Americans, AARP 2023

[7] https://www.statista.com/outlook/dmo/smart-home/united-states

[8] Laurie Orlov. (2022, January 12). The tech-support chasm is tough to cross for older adults. AgeInPlaceTech. https://www.ageinplacetech.com/blog/tech-support-chasm-tough-cross-older-adults



Aging in place and independence can be supported by ambient assisted living technologies. It is, however, taking much longer than expected for these technologies to be implemented as user acceptance and user needs have not been given enough attention. Addressing healthcare needs through smart devices in the home could be a good segue to encourage older adults to adopt smart home devices and AAL technologies. Sensors could be integrated into the network so they can monitor and communicate healthcare needs. In the context of health needs, older adults were willing to exchange privacy for greater freedom and autonomy in the home and to use even the most intrusive sensors (Jaschinski et al., 2021).

2.2.1 Data in smart homes

When we refer to 'data in smart homes', we are essentially referring to the information that is collected, processed, and used by the different devices and systems within the ecosystem of smart devices in the home. Devices using the Internet of Things (IoT), sensors, and other technologies that may be interconnected and get data from sources like security cameras, electrical appliances, and thermostats, are all collecting data about their usage. The data consists of information like energy usage, the occupancy status of different rooms in the home, the user's temperature preferences, and more. This collected data can be structured or unstructured, and it could be stored for analysis at a later point or be used in real-time, and is usually transferred to a cloud-based platform for processing and analysis. Analysis of the data collected from devices allows them to be 'smart' and make recommendations and give insights to the user based on their usage patterns.

Smart home users have varied understandings of what is considered as 'data,' which leads to them having different perspectives about sharing this data as well (Burrows et al., 2018). Smart home devices in the field of healthcare, for example, collect medical data that can be considered very personal, but any data that is collected by smart monitoring technologies or surveillance technologies can be extremely personal as well. The smarter the devices get, the more data they collect about the users in order to provide them with a better, more customized experience. As smart homes are collecting, processing, and storing sensitive information about individuals and their homes, it raises privacy concerns because there is a need to manage this data appropriately and implement robust security measures. Ethical and responsible use of data collected from smart home devices requires informed user consent.

Automation enables users to customize their homes to their schedules and preferences. The amount of data collected by smart homes about their users is directly proportional to the level of automation provided. The MIT AgeLab has created a framework that divides homes into 5 different groups based on the level of automation present in the home. As the level of home automation taxonomy increases, there will be increased levels of interoperability between the devices along with their own challenges. Interoperability plays an important role when it comes to technology adoption; 74% of those above the age of 50 believe that is important to have seamless integration of new technology they decide to purchase with the technology they currently own, whereas fewer of those ages 18-49 think this is true, as most technology they buy is already compatible with the technology they own (AARP Research, 2023). Older adults will also have to gain new capabilities to successfully live in these environments. The way in which we understand privacy and what capabilities and flexibilities are possible in the set up of automated homes today would also change, and we will need to gain new capabilities along with a lot of changes to understand how data privacy will be addressed in the future as we climb levels in this taxonomy. This thesis aims to create a framework around privacy practices and the perspectives of older adults regarding data privacy in order to enable a better understanding about addressing the changes in privacy requirements.

2.2.2 Data privacy in smart homes

An important component of data privacy is the documents that communicate what a company or organization collects, how it uses a customer's data, and what practices the company follows to store and/or destroy the data. Any company that collects personal information about a user is required to comply with privacy laws that vary across different countries. If a company fails to comply with these laws, there may be severe legal penalties, which could include fines. Hence, in an attempt to ensure companies follow and comply with the laws provided for each region, users are required to sign privacy policies and accept the terms and conditions documents created by such companies. Privacy policies have information that allows a user to understand the data practices a company follows. This includes details regarding the practices they follow around data collection, data storage, data retention, and how they might or might not be able to discard a user's data. These documents also provide important information regarding how a user can make changes to the way these data regarding them are collected, and various ways in which they can request the already collected data to be deleted. To conclude, privacy documents are supposed to be informative documents that provide users with instructions around how they can control their own data that may or may not be generated as a response of using a particular technology or device. These documents also provide transparency regarding the way a company deals with a user's personal information. Companies that collect personal information are legally required to obtain consent from users to collect this data before they initiate any sort of collection. It serves as checking the box, and it is important to note that they might not necessarily have interest in making these documents easy to access and comprehend for the users.[9] Following in-depth semi-structured interviews, Zeng et al. (2017) recommended that user interfaces of smart home devices should be carefully designed to ensure users of smart homes know what they are consenting to in terms of privacy and security, possibly have physical privacy and security control options on the devices to make changing the settings easier.

[9] Luppicini, R. (2017, September 7). Nobody reads privacy policies – here's how to fix that. The Conversation. https://theconversation.com/nobody-reads-privacy-policies-heres-how-to-fix-that-81932

The Internet of Things (IoT) in smart homes enables various physical and virtual environments and objects to communicate with one another. Notre et al. (2014) highlight the need for user-friendly and easily accessible ways to control the privacy settings of smart household appliances, along with how easily the privacy can be compromised within a smart home. Some of the challenges and implications regarding connected devices within a smart home are identified by Arabo et al. (2012). Various threats for users include the potential for identity theft, fraud, the presence of various points of entry for cyber-attacks, and network-based threats. There may also be multiple security issues in smart home devices. Jacobsson and Davidsson (2015) have made efforts to introduce risk analysis models to evaluate the security and privacy of smart home environments and environments using IoT more generally. Ali and Awad (2018) suggest that reliable user authentication methods such as biometrics should be considered when installing smart homes using IoT technology, as if proper steps are not taken to secure smart home technology it can be vulnerable to cyber-attacks that target information like user credentials, personal data and financial information. Some of the worst-case scenarios highlighted in this study are hackers getting unauthorized access to the smart home, which allows them to take photos through installed cameras, record conversations, and track live locations.

Another aspect of data privacy in smart homes is considering the time when a household decides to use a smart home device into the home, as there may be multiple people who could be subject to the privacy policies and user agreements the primary user consents to. There will be bystanders in a home who may have data about them collected by such devices, including other resident family members. This highlights that uninformed consent to certain privacy practices might not just put the data of the primary user at risk, but also others who share the space with them. This suggests that different privacy needs may exist in the same home; for example, the privacy needs of an owner/user of a smart home device may vary from those of a bystander in the home (Yao et al. 2019). A study by Wang et al. (2019) assessed privacy perspectives of older adults; the participants communicated that privacy was important to them, but they also showed an interest in co-designing and contributing to the design of such technologies along with a strong desire of understanding and being able to control their data.

2.2.3 Technology adoption among older adults

Research studies measuring older adults' technology adoption are somewhat limited, and even those that are in this space typically measure short-term rather than long-term use. Mitzner et al. (2018) concluded from their study that initial experience while using the technology predicted the probability of long-term use and provide evidence that design, instruction, and the way a product is deployed for older adults are important to include in models that assess technology adoption for older adults. Many older adults express not needing any new technology and may lack the motivation to learn how to use new technologies by themselves because they do not need them. Pihlainen et al. (2021) conclude that older adults are generally willing to and motivated to learn new technologies if they see upcoming benefits.

Fournier et al. (2022) conclude that there is a need for new approaches to improve privacy and security design so that there is a greater acceptance of technology by older adults. Quan-Hasse and Ho (2020) in their study observe that most older adults abstain from adopting technology and using it to its full potential due to a couple privacy concerns that are of high importance to them, like the fear of unauthorized access to their personal information and misuse of their information by unknown parties. The discussion section of the study suggests policy implications and design considerations while creating technology for older

adults. Ensuring that older adults feel like they have the essential privacy literacy required will build their confidence and in turn should lead to a greater willingness to adopt digital media and the internet which are essential to using or adopting any smart home technology in today's world.

Older adults usually take much longer to adopt a new technology in the market compared to younger adults. Recent studies emphasize the need for technology companies to adopt co-design and include older adults in addition to younger adults as potential users for various products they are developing during their early innovation and design phases, and avoiding stereotypes where older adults are considered as 'laggards' in the mainstream market in the technology adoption curve (Loos et al., 2021, Woodcock, 2014).

Smart home devices that use various technologies like the Internet of Things (IoT), Artificial Intelligence (AI), and Ambient or Active Assisted Living (AAL) robots can help to support older adults' needs as they age in their homes. Smart home technology, when adopted, has shown to improve older adults' quality of life (Aggar et al., 2023). Some smart home technologies can automate home tasks by learning from users' behavior. In this thesis, 'smart' home technology refers to any device or system in the home that is connected to the internet, and/or connected to other devices in the house (e.g., Amazon Alexa, Google Home, Apple HomePod). A laptop or a smartphone may be considered 'smart' if it is used as a hub to control the various smart devices, and a smartphone may also be used to interact with voice assistants like Apple's Siri. Smart home devices also have the capability to collect data about the home itself and about the people that live in it, and many such devices have the ability to store, analyze, use and share such data. Sometimes, such devices can perform tasks based on a user's habits or automated to perform tasks at particular times.

2.2.4 Digital accessibility

In today's world, many technology companies do not provide paper or hard copies of privacy policies and user agreements, so users are often asked to accept the terms and conditions and sign the privacy policies online. Because people must rely on the web for accessing these documents, companies should ideally adhere to certain accessibility standards to ensure even those with certain disabilities are able to view and interact with these documents successfully. There are accessibility guidelines that need to be followed by law if a company has users in the United States region; these are defined as the Web Content Accessibility Guidelines (WCAG) and must be followed by everyone who publishes their content on the world wide web if their websites are used by people or companies that operate or reside in the United States. These guidelines include a number of rules that publishers must follow in order to ensure everyone attempting to read and comprehend the content on the web can do so successfully.[10] Understanding the content presented on a digital platform is an important aspect of digital accessibility. The WCAG guidelines have four principles, as known as the POUR guidelines, that create the foundations for accessible web content: 1) Perceivable, 2) Understandable, 3) Operable, and 4) Robust.

Some of the WCAG include the responsiveness of websites to: the different width and height of screens that users could potentially view these documents on; having all the functionality available on the websites being accessible through the keyboard; and having the websites designed in a way that helps the

[10] https://www.w3.org/TR/WCAG20/

users avoid and subsequently correct mistakes they might make while operating the website. The guidelines also imply that websites should be robust, maximizing compatibility with current and future assistive technologies.

2.2.5 The concept of consent in technology use

Consent models today with respect to data collection and use among smart home technologies are often in the "take it or leave it" format, which means that users either consent to the policies to use the product or service, or they are not able to use it. If they decide not to provide consent, they will lose access to the product or service immediately, these models do not collect consent in a meaningful manner. Meaningful consent offers the consenting party substantive choices, including the ability to withdraw consent given previously or the ability to give partial consent if the user does not agree with everything written in data collection and use documents. The consent for many smart home technologies today is often irreversible, and once given cannot be revoked by a user. As a result, the moment a user gives their consent by checking the box that often says 'I agree to the terms and conditions' is particularly significant, because it grants that company or entity permission to collect and use their data, while controlling everything that could happen to that data in the future. Privacy policies and user agreements often make use of so-called dark patterns in user experience design in order to ensure the user signs and agrees to everything written in these documents.

One current problem with consent and privacy policies is the length of such documents. The documents usually have pages in the double-digit range which have thousands of words. This makes the documents virtually unreadable. The timing at which these documents are presented is also crucial and does not facilitate understanding; most of the digital privacy policies presented by companies and organizations are shown when users are signing up for the service or product. This time is filled with uncertainty as the user may not yet be fully aware or familiar with the service product. Finally, the policies are also not accessible to average people, as the terms and language used in them are often legal ones and usually understood only by people in the law and policy fields.

Out of the only 9% of adults who say they always read privacy policies, and the 13% who occasionally read them before agreeing to their terms and conditions, only 22% of these say they read them completely and all the way through to the end before signing, according to a study done by the Pew Research Center in 2019. More than 36% of adults who responded to the survey mentioned they have never read a privacy policy before signing it. A majority of adults aged 65 and older do not read privacy policies before signing them, with 74% reporting never reading them.

2.3 A values trade-off

Privacy, security, and reliability are some of the factors that are most likely to cause older adults to shy away from adopting new and upcoming technologies (Yusif, Soar and Hafeez-Baig, 2016). Within privacy there is a lot of uncertainty about who has access to the data, and where the data collected from smart devices and technology are saved (Cahill et al., 2017). A trade-off also often occurs when a user is not fully made aware of the ways in which information they provide might be used by the collecting organization now or in the future, as not knowing enough can make people believe that the privacy trade-off might be worth the convenience they will get.

An example of how people's views of trade-offs keeps evolving and changing with the times can be derived from focus group research (Pew Research Center, 2016) where people were asked about whether they would be willing to adopt a smart thermostat that monitored location of members in the home if it enabled them to save energy through planned changes in temperature. This privacy trade-off was unacceptable to the majority of the people in 2016. In 2023, however, a majority of the houses in the United States use a smart thermostat that collects information about location in some aspect, either via location sensors, motion sensors, or presence sensors.[11]

This change in behavior could be due to the advertising efforts of the results and benefits of installing smart home thermostats, which include energy savings, and the convenience that learning thermostats offer as they do not require users to change the temperature manually. Customers may view these benefits as good enough and as a result trade their privacy off to enjoy the benefits and the convenience that come along with the use of the thermostat. Higher adoption rates of a particular technology do not necessarily mean that people feel comfortable using the technology, it may mean that people view the benefits offered as more valuable than the privacy trade-off they have to make. However, the fundamental question here revolves around the necessity or the feeling of having to trade privacy off in order to get some kind of convenience from adopting a technology, and that does not have to be true. Responsible design of such technologies and everything that goes out with them will help informed adoption and enable people to feel more comfortable using these technologies.

2.3.1 Trade-off between privacy and convenience

Technology today is advancing at such a rapid pace that the laws and regulations present are often outdated. Information sharing means exchanging the data a user has agreed to share or to be collected with other companies, organizations, or entities.[12] Surveillance means closely watching a person and keeping track of their activities minute-by-minute. Smart home products today often behave in a manner surveillance technology would behave, and hence there needs to be a distinction between sharing information more generally versus sharing the information in a manner that could be used to surveil a user.

Technology offers great convenience that often overshadows the privacy compromises a user has to make to use a product or service; the convenience aspect of smart home products results in the instant agreement to the 'I Agree' checkbox at the end of privacy policies and user agreements of various devices. In today's world, privacy has become like a currency that one trades off for the convenience they want to have in their everyday life.[13] Yet compromising or trading-off privacy can cause direct personal harm, which is generally overlooked by individuals (Ozeran et al., 2021). The concept of privacy has changed significantly in the past decades, and more often than not, people do not understand the amount of harm that can be done when they trade their privacy off for the sake of convenience, especially privacy around their medical information. Ozeran et al. (2021) recommend that elevated efforts are required by professionals who are in the technological organization making applications that collect personal data

[11] https://www.pewresearch.org/internet/2016/01/14/scenario-home-activities-comfort-and-data-capture/
[12] https://www.techopedia.com/definition/24839/information-sharing#:~:text=Explains%20Information%20Sharing-,What%20Does%20Information%20Sharing%20Mean%3F,shared%20on%20Facebook%20or%20YouTube)
[13] https://www.publicissapient.com/insights/privacy-or-convenience--what-s-the-tradeoff

with a focus on any data that is health related to educate their users regarding the advancements in data collection practices and the things that can go wrong.

A report by the Pew Research Center (2016) concludes that trading privacy off for convenience is very dependent on what benefit the particular technology or service would have on a particular demographic of people. Their research report pointed out that different age groups looked at what was convenient to them differently; those above the age of 50 were willing to trade privacy off for being able to access medical records online, whereas the majority of those below 50 thought this was unacceptable. In contrast, people under 50 were more willing to sacrifice privacy to use a social media platform as compared to those over the age of 50.

2.3.2 Trade-off between privacy and autonomy

]When there is a trade-off between autonomy versus privacy, users tend to prioritize autonomy in the majority of the cases. Older adults accept smart home technologies with monitoring: when they get benefits like aging in their own homes rather than moving to an assisted living facility; if their physical and cognitive safety increases by the adoption of smart technology; and if the information gathered by the various sensors and devices can be transferred to their circle of care.[7] With the onset of diseases, illnesses, and other aging related health issues, older adults tend to accept more and more obtrusive levels of smart home technology for monitoring if they are able to maintain their current level of autonomy (Daphne et al. 2011).

The trade-offs between privacy and autonomy, security, and comfort have been an ongoing discussion for more than a decade. Townsend, Knoefel, and Goubran (2011) consider the trade-off between privacy and autonomy and conclude that older adults are willing to accept monitoring technologies like video cameras, which are ranked as the most intrusive type of sensor monitoring technology according to their research, if they can continue to live at home and maintain the same level of autonomy. After nine years, the scenario has not changed much, as Ehrari et al.'s (2020) study suggests the trading off the privacy of older adults is still necessary to preserve their personal integrity and autonomy, and if the benefits of smart technology outweigh the risks posed by their health.

People ages 40 and older were asked to rank their preferences among five different types of sensor technologies. All the age-groups ranked complete visual information (e.g., video camera) as their least preferred monitoring mechanisms; they would only adopt such cameras if the only other option was to relocate to a care facility/assisted living. They preferred self-activated health line alarms, devices sharing physiological information like blood pressure monitoring at regular intervals, devices sharing physiological information continuously (e.g., wearable heart rate monitor), and location and position sensors (e.g., sensors in bathrooms and kitchen) - in descending order (Daphne et al. 2011).

2.3.3 Trade-off between privacy and security

Even today, older adults are willing to accept smart technology in an emergency if it offers lifesaving security benefits, and privacy concerns are outweighed by these benefits in such situations (Schomakers and Ziefle 2022). The existing research focuses more on the design of the smart home technology itself, as little research exists on best practices for companies to ensure that older adults know where their data is

going so that they feel more secure about using smart technology, including benefits it offers, to result in more informed adoption.

Francois Portet et al. (2014) have reported that since smart home devices are often used by older adults for health-related monitoring like fall detection and movement detection, for which video sensors that are often considered highly intrusive are used, the devices contain data that is of vital importance and extremely private. It is important that these smart devices provide reassurance to older users about to whom all the collected data will be accessible, if and when the data will be discarded, whether it will be stored anonymously or not, and if changes can be made to the default storage and collection settings. Technology designed for older adults is expected have higher adoption (Pireh et al. 2022) rates if the researchers working on the development of the devices:

> (1) provide interfaces via smart devices to control and configure the monitoring system with feedback for the user; (2) include various sensors/devices to architect a smart home solution in a way that is easy to integrate in daily life; and (3) define policies about data ownership.

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03.

Evaluation

Evaluating Privacy Policies and User Agreements from the Perspective of the Aging Population

3.1 Introduction

In this chapter, a total of 30 documentations including 24 privacy policies of individual smart devices and 6 privacy terms and policies from platform providers were reviewed to understand their commonalities and shared limitations. Although there have been significant advances in the technology available today compared to a few years ago, privacy communications to users accompanying these technologies have changed little. This chapter explores how companies collect, store, and use the data from smart home devices and compares the content from privacy policies of various companies to look at how the policies can be different across companies and how this may affect the way a user might interpret the device being safe to use or not from the data privacy perspective.

3.2 Method

A secondary data analysis/archival study and literature review were conducted. This study undertook a purposive selection of 24 distinct privacy policies of smart home devices and 6 user agreements belonging to various companies. The sample was deliberately chosen to be representative of the most prevalent devices available on the market today. The study also considered the policies of companies utilizing third-party voice assistants, as well as those with proprietary voice assistant technology.

The dataset considers various aspects of user agreements and privacy policies including but not limited to: type of installation; hub requirement; supported voice assistants; type of device; product description; product name; name of company; the updates policy; the number of products the companies have; user friendliness of their agreements and policy pages; number of voices the voice assistant recognizes; who

has access to the data collected by the smart device; ability of the user to make changes and set preferences around the kind of data collected; the kind of data collected and its storage location; false wake frequencies; type of customer support; and what happens to the data after the user terminates or deletes the service.

3.3 Results

Some companies that own a big share of the smart home devices today, have extremely long privacy policies ranging from 9 pages (Amazon's privacy policy) to 49 pages (Philips' privacy policy). Some privacy policies have around 3505 words, while some have close to 11,950 words. A more detailed look into the different themes that emerged from the analysis follows.

3.3.1 Insights from the Evaluation

The similarities and differences among the various privacy policies and user agreements that were evaluated have been presented below in the form of 5 distinct tables:

Table 1 lists the number of pages and length of various privacy policies. Data privacy policies of smart home technologies contain all the information about how the data collected by the devices will be stored and used by a company. If a user wants to make any change to the default settings of the collection and storage practices, information about how to proceed with the same is found in these legal documents. These documents are extremely lengthy which makes it hard for all kinds of users to go through it entirely.

Table 1 - Number of words in privacy policies of different companies.

Company	No. of Pages	No. of Words
Google	28	5641
Amazon	9	3505
Apple	13	3394
Philips	49	11981
iRobot	25	8028

As shown in **2,** Amazon, Google, and Microsoft do not require a hub to be able to use the smart home speaker with the-inbuilt voice assistant. In contrast, Apple's HomePod Mini is the only smart home speaker with its in-built voice assistant Siri that requires a hub in order to complete the set-up. All the smart speakers have a Do It Yourself (DIY) installation, which means there is no requirement for a company representative or elaborate routine to set up the device. Older adults' ability to cope up with this DIY set-up has not been a focus of any study yet. However, S. Kim (2021) discusses the pain points older adults face when they interact with a voice assistant for the first time. Many younger adults find the set-up

intuitive and are hence able to do it without any external help. Setting up a smart home speaker usually requires the user to have an account with the company they are working with, and in some cases like Amazon's Alexa, the user also needs to subscribe to Amazon Prime in order to use the service.

Table 2 - Voice assistant and their set-up

Company	Product Name	Product Description	Voice Assistants	Type of Installation	Hub Required
Amazon	Amazon Echo Studio	Smart Speakers	Alexa	DIY	No
Apple	HomePod mini	Smart Speakers	Siri	DIY	Yes
Google	Google Home	Smart Speakers	Google Assistant	DIY	No
Microsoft	Microsoft Cortana	Voice Assistant	Cortana	DIY	No

As shown in **Table 3,** the number of wake words a voice assistant has associated with it differs from company-to-company. Amazon's Alexa has the most number of wake words, and if the user goes to the Alexa App, they can personalize their wake word, too. Cortana's wake word can also be customized. Google's voice assistant can be woken up by two wake words, but Apple's Siri recognizes only one wake word. Apple and Google do not allow their users to customize the wake word. There has been little to no research around older adults' preferences about wanting to set up their own wake word or if they would rather stick to the one already programmed in. Changing or updating the wake word usually requires a user to go to the application's settings, which may be challenging for a lot of adults over the age of 85 because using smartphones is not so common in their age-group and navigating settings adds another complexity layer to it.

Table 3 - Waking up voice assistants

Voice Assistants	Wake Words	Are the wake words customizable?	How many voices can the voice assistant recognize?	When does the voice assistant start recording?	Can more than one ID be added to the smart speaker?
Alexa	"Alexa" "Echo" "Amazon" "Ziggy"	Yes	Upto 10 different voices	All voice recordings/ sounds that are spoken or heard after the wake work 'Alexa' are collected	Yes, from Amazon Household

	"Hey, Disney"				
Siri	"Hey, Siri"	No	Upto 6 different voices	All voice recordings/ sounds that are spoken or heard after the wake work 'Hey Siri' are collected	Yes, from Assistant Settings
Google Assistant	"Hey, Google" "Ok, Google"	No	Upto 6 different voices	All voice recordings/ sounds that are spoken or heard after the wake work 'Ok, Google' or 'Hey, Google' are collected	Yes, from the HomePod app
Cortana	"Hey Cortana"	Yes	More than 1	All voice recordings/ sounds that are spoken or heard after the wake work 'Hey Cortana' are collected	

Table 4 discusses how different third party services work in connection with the voice assistant a user selects. 'Third Party Services' here could mean any smart home devices or wearables that might be in the home space and are connected to the voice assistant. Third party devices like smart lights, smart displays, smart doorbells, smart thermostats, etc. are connected to the voice assistant, which is in most cases one of the four identified above. There are multiple claims on Amazon's Alexa about listening and picking up conversations even when the wake word has not been used. Similarly, users have claimed that Google Ads shows them advertisements related to something they recently spoke about but didn't necessarily know was being recorded. Due to such experiences, many users around the world may consciously decide not to use a particular company's voice assistant because of perceived sketchy data collection practices. But users are often caught unaware when they choose to go ahead with other smart devices in the hope to stay away from the big players in the market when they buy smart lights from a company like Philips Hue, for example, and the voice assistant they have to use is either Amazon's Alexa, Google Assistant or Apple's Siri. According to the user agreements and privacy policies of voice assistants and the companies making them, if a user is using Alexa as the voice assistant for a Philips Hue as the third party product, they automatically by default sign on to all of Amazon Alexa's agreements and policies.

Amazon and Google save the recordings received through their respective voice assistants in the cloud by default. Amazon actively uses these recordings to train Alexa and offer users better services, whereas Google just saves these recordings in the user's Google account, and does not use them for improving the services unless the user specially opts in to this. Apple, on the other hand, just processes all the recordings on the device, and sends encrypted recordings to the user's iCloud where only people allowed by the user can view them; these recordings are not accessible by Apple. As shown below, there is a correlation between the company's data saving practices and the number of devices and services the voice assistant can be used with.

Table 4 - Third party services and connections

Voice Assistants	Type of documents to get access of the data	Accessing third party services	How long are the transcript or audio files retained till?	Devices and services the voice assistant has access to	Are the recordings stored in the cloud by default?
Alexa	User agreement and Privacy Policy	Permitted. Amazon's terms and conditions automatically signed if Alexa is used on a third party device.	Amazon retains customers' voice recordings and transcripts until the customer chooses to delete them (even then there are exceptions).	Number of Alexa compatible smart devices reached 100,000 in June 2020	Voice recordings are stored in Amazon Cloud by default and used to improve 'services' offered.
Siri	User agreement and Privacy Policy	Permitted, extremely limited devices enable Siri.	Connected to your random identifier for up to 6 months. After 6 months, dissociated from the random identifier and may be retained for up to two years to help Apple develop and improve Siri.	Select number of smart devices.	Recordings are processed on the device. End-to-end encrypted recordings are sent to iCloud and can be accessed by the user and people allowed by the user. Apple cannot access these recordings.
Google Assistant	User agreement and Privacy Policy	Permitted. Google's terms and conditions automatically sign if Google Assistant is used on a third party device.	Users can change default settings and delete the recordings or save them up to 6,12, 18,etc. months and then have them automatically deleted.	Over 50,000 devices from 10,000 companies	Recordings are saved in the Google Account, but by default nothing is saved. If user wishes to share their data with Google for improving the voice system, they can select to share the voice recordings

Table 5 considers how a company can update the terms and conditions of their user agreements, and how the user is informed of these updates. All the companies send emails to users if any changes are made to the agreements and policies, but none of the changes are highlighted in the email itself, and the user is often implicitly expected to go through the entire (20-plus page) document in order to understand what was updated. When users sign an agreement with the company, they also sign a statement that they agree to all the updates that will be made to this document or policy in the future, and no additional consent is required from the user for the updates that are made. Additionally, if companies require users to go through the

entire policies and agreements, an effort to make them user friendly needs to be there. Currently most of the policies and agreement pages on the company websites are not designed keeping users in mind.

Table 5 - Updates in terms and conditions

Voice Assistants	Where can information about changing default settings be found?	How user friendly is the terms and condition page?	Does the terms and conditions page follow the WCAG guidelines?	Does the user have to agree to changes and updates made to their terms and conditions?	Does the user get to view only the changes or updates made to an existing policy? or do they have to read everything in order to figure out what has changed?
Alexa	Updates and Privacy Policy	5	Somewhat	No, user received as email	Read everything
Siri	Settings on iPhone	7	Somewhat	No, user received as email	Read everything
Google Assistant	Updates and Privacy Policy	8	Yes	No, user received as email	Read everything
Cortana	Updates and Privacy Policy	8	Yes	No, user received as email	Read everything

3.3.2 Current Use of AI in Home Tasks

Artificial Intelligence (AI) today is present and being used in most smart home devices, the constant use of AI in smart devices and technology calls for an increase in continuous tracking and collection of a lot more data compared to pre-AI times. The more data AI collects about a user's preferences and usage, the more customizations and personalizations it is able to offer. As a result, users consenting to the privacy policies and user agreements of devices that use AI are essentially consenting to more and more data about them being collected that is stored in the cloud and eventually used by the technology companies to train and improve their AI as well as generate relevant recommendations to the user.

The smart home category in Mozilla Foundation's Privacy Not Included series concludes that artificial intelligence (AI) is currently being used by most of the companies in the smart home technology space. Most of the data that a device collects acts as the database for the AI to function and respond to requests made by the user. AI supports many tasks at home, such as managing energy usage, controlling the home climate, and various entertainment purposes. AI is used to respond to requests and questions that users make when they use voice assistants like Amazon Alexa, Apple Siri, Google Assistant, and Microsoft

Cortana. Voice assistants use natural language processing to listen to the users and understand requests to provide responses. When it comes to performing tasks in the smart home, AI is used in thermostats, for example, to learn what temperature the user likes at particular times of the day which is then leveraged to auto-schedule the temperature in the home. In some smart thermostats, AI is also leveraged to switch to clean energy whenever available to generate cost savings. A second example is camera based motion-detection, which is used as a cue to start recording in doorbells that have video enabled in them. There are some devices used in the home space, however, like the August Smart Lock, that do not leverage AI.

3.3.3 User Agreements and Privacy Policies

Something that most user agreements share in common is the tendency to instill fear and apprehension among older adults and users, particularly regarding the possibility of their personal information being sold to third-party entities and companies. This can result in users feeling vulnerable regarding their digital privacy protection. A majority of user agreements include a phrase like *'We do not sell your information to third parties'*, but if the agreements are read closely the next few paragraphs mention the various details the companies collect in order to help decide which advertisements will suit the users better. These details include the frequency of use, time of access, duration of access, location of access, use of one/many devices for accessing, links clicked while accessing, and links clicked while going through any other emails/ advertisements sent by the company to the user.

Every user agreement examined as part of the review of the 24 smart home devices has another phrase: 'We have the right to collect information regarding the device(s) you use to access the service they provide.' This essentially means they have the right to access information about computers, tablets, smartphones or any other electronic devices the user uses to connect to the service, details about the type of device used, model of the device and manufacturer, unique device identifier number (e.g., Google ad ID, unique ID for advertisers, Windows advertising ID), mobile carrier used, operating system (e.g., OS) of the mobile brand used, phone number of the user, any browsers and applications connected to the service, internet service provider used, IP address, and the device's telephone number (if it exists).

Consider this statement from Google: 'We do not sell your information to third parties' -but Google has the right to place Google Ads based on the user's personal information and all information collected. which in turn may entice users to make purchases. Google is paid by these third parties for placing their advertisements. Further, every device that is connected to Google Assistant as the voice user interface (VUI) collects all the same information that the Google device itself would collect.

3.3.4 Voice Assistants and Their Connection to Third Party Smart Devices

All companies that manufacture smart devices that don't have their own voice assistant in order to operate the device require users to onboard a voice assistant of their choice. When a user decides to use a voice assistant that is not created by the company whose device they are using, they automatically sign all user and privacy agreements that the voice assistant creator has. For example, a user of Philips Hue's smart home lights is automatically and implicitly signing the user and privacy agreements of Amazon if they decide to use Amazon Alexa as the device's way of communication.

The voice assistant is continuously listening to the conversations it hears if it is plugged in, and with the help of AI it decides whether to switch on or not based on the presence of the wake word within the conversation it is listening to. Amazon Alexa has more than five5 wake words, and a number of additional

wake words can be added. On the other hand, Google Assistant and Apple HomeKit have only one wake word each. The number of wake words is directly proportional to the number of false wakes a smart device might experience.

Because of the numerous wake words the three major voice assistants have today, false wakes are very common, which means the AI thinks the user is asking it something and starts listening, saving this audio and transcript to the cloud eventually. Companies often use this saved data to train the AI the voice assistant uses and the database it refers to; depending on the company it is either used in the audio recording format or converted to transcripts. Which company's voice assistant used also defines whether this data will be deidentified with the user's profile or not. While most companies do de-identify this data, they do use it to deliver to users personalized advertisements that they are paid to place.

3.3.5 Updating Privacy Settings of Smart Home Devices

All the user agreements and privacy policies concerned with smart devices in the home using AI state that the settings can be changed based on the user's preferences. The default settings collect the data and store it in the cloud, but these settings can be changed in the smart home device's application. This makes it problematic for the older adult population, as many may depend on their children or grandchildren or a third party for the set up required for the smart home devices. These settings define how the AI behaves, collects, and stores information in the cloud (or not). If users are not tech savvy enough to change settings through a smartphone application that the company or the third party has set up, it suggests that they were not considered as a primary user when the service was designed.

User agreements are often now not included in written form in the device's packaging, and companies that do include the agreements in the packaging print them in extremely small text (8px or 9 px), which is difficult for older adults to access as a majority of the population experiences at least one form of vision impairment. The research question of what format is best suited for this audience needs further investigation. In the case of a printed booklet, older adults' preference of whether they want bigger text with potentially more pages in the booklet, or sticking to the smaller text with lesser pages approach, is unknown. The current digital format of user agreements is the most common, however, this format contains various hyperlinks to additional pages that include 'Privacy Policies', 'Exceptions', and 'Additional Data,' which a user may not always end up reading - should they even choose to read the agreement in the first place. Default settings that a device comes with are almost universally in the interest of the company gathering the data and without reference to user preferences, hence these settings need to be changed if users (including older adults) want to change what data these devices capture and what they do with the data. If there is an easier way to make changes to these settings for this population, that will support the principle that older users will make informed adoption decisions that are sustainable and comfortable for them in the long run.

3.3.6 Dark Patterns in the Design of Privacy Documents

A dark pattern in user experience occurs when designs push and encourage the users to do things that are of benefit to the company rather than to the user (A. Narayanan et al., 2020). Dark patterns in user experience design are features that often have the intention to nudge or lead the user to do something they would not usually want to go ahead with. These types of designs are also known as 'Deceptive Designs'. For example, when a user is on an application or web page, they often want to be able to do the task in the

shortest time possible, so they may select the path that is the easiest and requires the least amount of effort and resistance. While doing this, a dark pattern or deceptive design nudges them into making selections that are intentionally displayed as obvious but would not otherwise be selected by the user.

Analysis of the current privacy policies and user agreements are designed has led to a conclusion that multiple patterns in user experience design that are referred to as 'dark' have been used in these interfaces. A few examples of these are: (1) No page numbers, and a single long scroll. This makes the user believe the document is much smaller than it actually is. A 27-page privacy policy can be scrolled through within 5 seconds, whereas page numbers enable the user to gauge how long a document is and how much information they are agreeing to. (2) Offering two checkboxes in such documents, one that says the user is agreeing to the terms and conditions after reading them, and one that says the user is declining and not agreeing to the terms and conditions they have read. The default option is always 'Yes, I agree,' which makes users believe that it is the most common answer and often the obvious one. (3) An option that says, for example, 'No, I decline' has a lower contrast as gray text is placed on a white background. The, 'Yes, I agree' option is bold and has high contrast with black text on a white background.

3.4 Discussion and Conclusion

The privacy policies and user agreements assessed in this evaluation use complicated language and are presented to the users in an extremely information dense format. All the privacy policies state that they collect and store the data from the user's activities, and changing the storing practices requires the user to go and change the settings present in the company's Android or iOS application, the steps to change these settings are present in the privacy policies that have between 9 and 49 pages.

Consent in Other Industries. The concept of consent is present in many different industries like the medical industry, human subjects research, etc. where the emphasis is on ensuring that people know what they are agreeing to. In the medical field, this is done by asking the patient or their family member to sign a consent form. The nurse practitioner or doctor themselves explain the procedure(s) to the patient/ family in detail and then ask them for their signature. It is similar in human subjects research as well, where a participant is asked to fill a consent form prior to their participation in the experiment or study. The primary investigator of the study explains the harms and benefits of participation in the respective study to the participant, following which they make a decision regarding whether they would like to proceed or not. By law, the investigator is required to explain the content of the consent form to the participant. Similarly, technology companies collecting any kind of personal data are required by law to present the details of collection, storage, etc. to the users, but based on the evaluation of the privacy policies they present the users with, it is clear that they do not make any effort towards ensuring that users signing these policies understand what they are consenting to.

Documents such as rental agreements and leases, as well as offer letters with a company are also binding communications with a lot of terms and conditions mentioned in them, however, they always give the person reading these communications a time frame within which they can either decide to return the signed document or not. These industries give the reader of the document enough time to read and comprehend the information, ensuring that they can make an informed decision based on the information provided. The time frame is one of the distinguishing factors when it comes to privacy policies and user agreements in

the technology industry, the companies usually seek consent right when a user needs to use their service or product (e.g. book an Uber or Lyft to go from location A to location B, agree to the terms and conditions of Instacart or DoorDash after you have placed all the items in your cart and are ready to checkout, etc.) which puts the user under pressure to just accept the terms in the documents without getting a chance to truly understand what they are agreeing to.

Need for Better Design of Privacy Communications. There is a need for user agreements and privacy policies to be easily accessible; companies publishing the user agreements and privacy documents should be more mindful of how these are presented to the user, whether online or hardcopies. Companies should try, for example, to adhere to accessibility standards published by the Web Content Accessibility Guidelines (WCAG). For older adults to fully utilize smart home technology, we need to make sure they are adopting it in an informed manner. They may also be able to use it in a sustained manner once they see its value and feel confident about being in control of their data collection and where it goes. It is important that companies build their trust ethically, and to ensure that older adults are not required to trade off their privacy for autonomy and security. It will also be helpful to think of new ways to offer and get consent, so that users may better comprehend the information and make informed choices of what they want to share and not share.

It has been reported by Pew Research that the rates of older adults who own smart technology and technology in general have increased sharply. On the other hand, the report also mentions that just 26% of older adults report being comfortable using the technology they own. As a result, long-term use could be affected by various factors including comfort with the technology, and privacy could be one of the reasons why 74% of the older adults say they are not comfortable with using technology they own. Better design and efforts towards making privacy communications more accessible and understandable could play a huge role in ensuring that users adopt technology they are comfortable using.

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04.

Smart Home Technology: Older Adults' Privacy Concerns

"It did not even occur to me that I could change the privacy settings, and I don't know how I would do it"

a female older adult and smartphone user

4.1 Introduction

This chapter explores the attitudes and beliefs older adults have about data privacy in smart home technology, 29 older adults over the age of 85 were interviewed in focus groups both virtually as well as in person, they were also asked to fill out a survey prior to the interviews that helped in getting a better understanding of their technology experience and privacy concerns. The chapter discusses the various concerns older adults have regarding data privacy, and how technology companies can navigate these concerns if they really want to promote informed adoption of their technology among the older adult population.

4.2 Technology Adoption Among Older Adults

Studies focusing on technology adoption among older adults have not been as popular as studies that focus on the adoption of technology across the general population. Many people who design today's technology are younger adults, and as a result there are often some missing elements within technology that are designed and developed that fail to meet what older adults need and require. As a result, the final designs that go into market may perpetuate stereotypes that the younger generation has about older adults' behaviors, needs, and wants. Many of these designs are made by young people who don't try to put

themselves in the shoes of older adults when designing them (Coughlin and Yoquinto, 2018). The stereotypes and discrimination around ageism has been receiving less attention in the industry, designers often don't consider listening to older adults' preferences and likes while designing technology. Co-design has proven to be a successful concept in design, and using the co-design framework while designing products for older people, or simply involving them as one of the primary users can help them to adopt the technology or product successfully (B. Ostlund et al., 2020).

Prior studies have highlighted the importance privacy and ethics play in technology adoption among older adults, but current products in the market tend to focus more on safety related concerns (Kang H. G. et al., 2010). Safety is equally important, but is not the sole deciding factor that will influence older adults to adopt a particular technology. Our study attempts to look at how different companies making technology in the smart home space handle users' data and communicate with them about the ways in which their data is stored and used.

Technology may offer many benefits for older adults, including multiple accessibility features. For example, newer hearing aids can often be connected to the user's mobile phone so that they directly receive and hear the ring and can complete the entire call hands-free without having to touch the phone. Many older adults who suffer from hearing impairments have said that this is an extremely helpful feature as they can hear and attend to calls they receive, which would otherwise go missed. In the past, hearing aid technology merely amplified sound. Whereas, today this technology can collect and save data from users' as it can be connected to multiple devices in the home which could potentially generate revenue for the company,

Previous research (C. Lee, 2014) examines a variety of factors that influence older adults' adoption of technology. Lee concludes that there are multiple important factors such as trust and independence, in addition to existing factors like usability, usefulness of a technology, and the cost associated with it, that affect technology adoption. Another research study (C. Lee and J. Coughlin, 2015) discusses these various adoption factors in-depth and the implications they have for current products that are in the market. The current study explores similar factors - i.e., accessibility, technical support, and support for independence, but through semi-structured interviews and survey questions from the perspective of data privacy. This research also considers potential changes smart home technology manufacturers could make to their data privacy practices to support older adults' adoption of technology in an informed manner, and support continued use by making them feel comfortable and in control of the data that is collected.

4.3 Methods

4.3.1 Participants

We recruited participants for this study from MIT AgeLab's Lifestyle Leaders' Panel. The Lifestyle Leaders Panel is composed of older adults over the age of 85, some of whom have adopted technologies such as smartphones and smart home devices, and some of whom have not. This panel also has shown keen interest in contributing to research for the aging population to make the world a better place for older adults. To recruit participants for the study, an email was sent to this panel of approximately 60-65 active members, mentioning the topic of the study; members were asked to fill out a Google form if they were interested in participating. 29 older adults responded to the study invitation where 86.2% (*n=25*) of the

participants confirmed their participation in the study. The study invitation included three questions that helped place the participants into appropriate discussion groups based on their technology usage and concerns about data privacy.

For the in-person study, 5 participants over the age of 85 were contacted via phone and asked if they would be willing to take part in this study, and each one of them confirmed. They came to the MIT AgeLab in Cambridge for 2 hours to participate, and they were served lunch. A survey regarding data policy and smart home technology was sent to the Lifestyle Leaders' Panel two days prior to the virtual study. 37 members responded to the survey; and 94.6% of them volunteered to take the survey and 5.4% of them opted to not proceed. Out of the participants that took the survey, 40% (*n=10*) lived in either senior independent living, an assisted living facility, or a nursing home.

4.3.2 Sample Demographics

Age: Oldest participant: 96 years old, YyoungestYoungest participant: 85 years old, male participants: 58.3% (*n=14*), female participants: 41.7% (*n=10*)

Out of the 24 participants in the study, we know that all were 85 years and older. However, we had access to the exact ages of 20 out of 24 participants. The average age of the 20 participants was 90.5 years. From the participants who had given us access to their exact age, 2 participants were 90 or older in 2022, and 18 participants were 89 or younger in 2022.

Technology Experience: Of all the participants that responded to the survey, 34.5% said they did not own any smart home technology devices. 51.72% said they owned some kind of smart home technology, whereas 13.8% said they were unsure or didn't know if they did or did not own smart home technology. Out of the ones that were not sure, they were given a list of smart home technology devices and asked if they owned any particular ones from the list, where 21.4% of them said they did. Everyone who participated in the survey said that they had some level of experience with technology.

4.4 Data Collection

The RSVP form was constructed intentionally so that the questions would help us stratify participants into focus groups during the virtual discussion. (1) Do you own any smart home technology devices? The ones who answered no or unsure to these questions were assigned to one group. (2) Did you know that all users are required to sign user agreements/ terms and conditions/ privacy policies in return to be able to use the service a company provides? (3) Do you make a point to read the user agreement/ terms and conditions/ privacy policies of products and services you use? The ones who said they owned smart devices in the previous question and said that they were aware of signing these documents but did not read them were assigned to one group. This was around 10 participants, so we split them into two groups with 5 in each for this particular category. Finally, the people who mentioned owning smart devices as well as said they read privacy policies and user agreements were assigned to one group.
We began the session with a 20-minute presentation about data policy and smart home technology to ensure everyone was using the same definitions for what we meant by smart home technology, data, data privacy, user agreements, etc.

Table 6 - Key questionnaire items used in this study

Questionnaires	Items and variables
Pre-workshop Survey	<u>Key questions</u> ● How would you rate the understandability of smart home devices' privacy policies and terms and conditions agreements? ● How creepy do you think voice assistants are? (for example: Amazon Alexa, Google Assistant, Apple's Siri, etc.) ● How fair is it to trade off your privacy for technology that helps you maintain your autonomy? ● How comfortable are you with voice assistants (for example: Amazon Alexa, Google Assistant, Apple's Siri, etc.)?
Research questions (focus group discussions during the workshop	<u>Experience with voice assistants</u> ● What are your thoughts on voice assistants listening to your conversations? Do you believe that they listen to everything you might speak in your home? <u>Data privacy and fears</u> ● Tell us more about any fears or concerns you might have about smart technologies like voice assistants stealing your personal information. ● What kind of information do you fear they will steal? In other words, are you concerned that the company has access to details like your wake-up time, medication time, etc. or do you fear them having access to your credit card details that might allow the assistant to make unauthorized purchases? ● Could you tell us about a time you might have changed the default privacy settings of a smart device you currently use or used in the past, how was the experience? Did you face any hurdles? ● We noticed through the RSVP form that you generally don't read the privacy policies and user agreements that come with the smart devices. Could you elaborate on the reason why you chose not to read these documents? ● What would motivate you to read these documents before you sign them? <u>Aging-in-place and technology adoption</u> ● What are your thoughts on the capability of technology today to allow you to live in your home for longer? In other words, do you think technology that would delay the move to a care facility or assisted living by allowing you to maintain the same level of autonomy exists today?
In-person study -	<u>Key questions</u>

questions	● What are your thoughts on the capability of technology today to allow you to live in your home for longer? In other words, do you think technology that would delay the move to a care facility or assisted living by allowing you to maintain the same level of autonomy exists today? ● What would you consider if you were making a decision about whether to continue to live in your home independently by adopting additional smart home technology? ● Do you generally read a physical printed paper that requires your signature? What are your thoughts on digital vs physical signatures? ● Has there been an instance where you read a privacy policy or terms and conditions agreement and decided not to use that particular smart home device?

4.5 Results

4.5.1 Belief that Privacy is a Myth

Lack of Knowledge about Privacy Settings: Throughout the focus group discussions, multiple themes were brought up indicating that participants did not believe privacy within smart home technology even existed. Data collection practices, privacy settings, and the users' abilities to change these settings were very poorly understood by participants in the study. Smart home user agreements and privacy policies cram a lot of information into them, which contributes to this lack of knowledge, as users don't read these long and intense documents before signing them.

> *It did not even occur to me that I could change the privacy settings, and I don't know how I would do it (female older adult, smartphone user).*

There was a strong sense of belief that voice assistants like Apple's Siri that accompanied iPads and iPhones were always listening to the users, rather than getting activated only when the wake word was heard. Siri and Alexa were very commonly used among the older adults that participated in the study, but there was no clarity among them about how the voice assistant could be deleted from the phone, and uncertainty regarding this even being a possibility. A majority of the participants believed that if they wanted to use any service provided by Apple, Siri would be present and remain activated on their phone or devices by default.

> *Can we remove Siri from our iPhones or is she always there? Does anyone know how to deactivate her? She is obviously always there (female older adult, smartphone user).*

Presentation of Privacy Policies: The length of the privacy policies and user agreements often contributed to why users don't end up reading the information present in these. Many participants highlighted that the language used in the privacy policies was meant for legal professions to understand, and not for older adults or anyone outside the legal space. If users decide to read these documents, they would probably need to look up meanings of multiple words as they are not designed for average users and not easily understood by people without a legal or technical background.

I just can't deal with it. With forms and those contracts with minute print and hours of reading and interpretations, I have to look up some of the meanings (female older adult, smartphone user).

4.5.2 Concerns About Personal Information

There was a lot of uncertainty about when voice assistants wake up and start listening, and many participants in the study referred to voice assistants in the house as '*uninvited guests*'. Users are unable to make informed decisions about consenting to anything involving their personal information due to the time it takes to read these documents and the multiple readability problems that come with it. Consent fatigue is developed due to the number of times a user is asked to make decisions regarding their personal information. Even if these policies and agreements are made shorter, more accessible, and easily comprehensible, the issue regarding the frequency to which a user needs to give this consent is still high. During the study, participants raised concerns about companies not making the intentions of collecting personal information clear, and the various purposes their personal information would be used for beyond the reason for which it was originally collected. In our study, older adults believed that they are being left behind by current document formats, where they are expected to read thousands of words before understanding how their personal information will be used.

Financial Information Being Leaked: Concerns over financial information being leaked was higher than any other concern with regard to personal information. While some users completely avoided using financial services online, some had a view that even if they end up paying an amount that they did not intend to due to not paying attention and signing an agreement, they can always dispute it with the bank and get their money back. A majority of users expressed that they are not comfortable sharing any credit card details with technology providers.

Privacy and Misuse of Medical Information: Another big concern within personal information was personal medical information being misused. Although most older adults in the study appreciated the benefits the medical field has seen with the rise in technology through remote physician visits and telehealth, some also raised concerns over medical information being misused and their families having to pay for it.

I am concerned that some companies having access to my medical information might end up affecting my children and their children's insurance. Genetic information being in the reach of certain insurance companies might lead to some inference to be drawn (female older adult, smartphone user).

4.5.3 Eagerness to Learn about New Technologies

A majority of the participants in the group that did not use smart technology were comfortable using a personal computer and/or tablets. Even though they had been averse to using some technology due to data privacy concerns, they expressed keen interest in knowing more about the potential benefits of these new and advanced technologies and how their current ways of living might be enhanced if they adopted and started using these devices. Most of them were of the opinion that they are restricted to the minimal technology they use today only because it is enough for them, and that they are unaware of the upcoming technology that exists out in the world.

Am I missing something that could add value to my life and make this current moment in time better? Even if I was open to some kind of technology, I don't even know if something like this exists (female older adult, Siri and smartphone user).

Multiple participants expressed that technology education for older adults could be beneficial to them, as they find it hard to keep up with the current technology inventions. 26.9% of older adults said it was easy for them to learn new technologies, whereas 42.3% older adults said it was extremely or somewhat difficult for them to learn new technologies. Another 30.8% said it was neither easy nor difficult for them.

4.6 Discussion

Although participants (*n=24*) in the study were divided into two groups based on their ownership of any smart devices, everyone demonstrated a strong interest and eagerness in learning more about technology that is out there today that could better support their needs. A majority of the participants were open to adopting technology that would improve the quality of their life, and a primary reason that many had not yet done this is just because they aren't even aware that such technology exists. One participant who has owned a robot since 2018 mentioned that he enjoyed interacting with it, but it had stopped working for a year or so, and he had not found anyone to repair it. Many such conversations highlighted the need to expand efforts, either through families or companies, to help older adults maintain their technology. Among those who were concerned about privacy and are not yet using any smart home devices except a smartphone, there was also a lot of emphasis throughout the in-person as well as virtual focus groups on the accessibility of smart home devices' privacy policies and user agreements. A lot of older adults expressed their frustration about not being able to access these documents because of the low visual and cognitive accessibility standards followed while presenting them. Technology companies having clearer and easily understandable privacy policies about how they use and store collected data will enable older adults to feel comfortable while using the devices with less fear of compromising their personal data.

4.6.1 Implications

Need for Technology Education: This need was highlighted as part of a question that asked older adults to elaborate on whether they see digital signatures and physical signatures differently. Many participants commented and took part in this discussion and mentioned that they preferred physical signatures, as people from their generation were more used to signing a document and being held accountable for it by using a pen and paper. They also pointed out that this might be the way their generation thinks and these insights might be particular to the 85+ group, as a big percentage of them never really got acquainted with digital signature technology that well. Participants also expressed the comfort with signing using a pen and paper, as there is a real person on the other end who asks for this signature, and any or every doubt that is there in the signer's mind can be clarified or discussed; often times the person seeking the signatures even explains the document briefly before expecting a signature - which is completely eliminated in digital signatures, particularly for privacy policies and user agreements.

Discussions around how the notion of signing a document digitally could be made similar to physically signing led to exploring if adding summaries of what the content is all about in the beginning would help comprehension. A number of the participants in the study owned a smartphone, specifically an iPhone,

but did not use Siri (Apple's voice assistant) on it due to privacy concerns. Siri has limitations, but at the same time the voice assistant can be useful to older adults as it requires only voice commands in order to operate. Statistics have shown that 20% of older adults above the age of 85 suffer from permanent vision loss and other vision impairments like impaired acuity and.[14] These data suggest the important support voice assistants could play in the lives of older adults in this age group, and hence if more older adults are comfortable with voice assistants, their social life and interaction with others could see an increase. Adding summaries that address concerns seniors might have and how these can be navigated when decisions about enabling/ disabling certain technology that you could use on their existing devices will be valuable to help them make an informed decision.

Designing for Comprehension and Accessibility: The format of the documents as well as the language used to convey the material is not designed for comprehension. The various companies designing the smart home technologies could include older adults as one of their personas while designing the product, as this will help to ensure that they are included as a potential primary user of the device. Privacy guidelines that need to be signed digitally should also ensure that there is a summary of what the document contains. Transparency will help all users attempting to make a decision on whether or not to sign the policies and agreements, not just older adults. Clearer and upfront information regarding changing the default privacy settings of a device will also encourage users who currently don't use smart home devices due to privacy concerns to take a look and re-evaluate their decision by helping them understand who controls the data and how these settings can be monitored and changed (or not).

Need for Revamping the Current Presentation of Privacy Policies: The above implications suggest that there is much information present in documents like privacy policies and user agreements that is useful for the users to enable them to manipulate privacy settings. If the users are able to change the privacy settings according to their preferences, they may be more comfortable while using the devices they own. Consenting to personal data being collected, stored, and used by technology companies is mandatory these days if we want to use a particular service or product. A lingering question in the minds of many participants was the possibility of revoking this consent if they feel uncomfortable while using the service. Currently there is an absence of revoking consent given to technology companies. Privacy policies do not allow for a user to agree to or disagree with a select set of terms and conditions, all terms and conditions must be agreed to or disagreed with. A research study (S. Egelman et al., 2009) has also shown that the timing and design of notices can influence how individuals respond to them in regards to their privacy.

4.7 Conclusions

The overall understanding from this research was that older adults perceive the documents published online that contain privacy related information to be presented in a form that only lawyers or an

[14] Centers for Disease Control and Prevention. (2022, October 31). *Prevalence estimates vision loss and blindness*. Centers for Disease Control and Prevention. Retrieved January 5, 2023, from https://www.cdc.gov/visionhealth/vehss/estimates/vision-loss-prevalence.html#:~:text=20%25%20of%20all%20people%20older,individuals%20than%20among%20White%20individuals.

individual from the law field will be able to comprehend. These documents are not designed for consumer understanding but rather for the companies to protect themselves from lawsuits (if filed). A summary of what the documents mean at the beginning will be very helpful in order to increase adoption of smart technology like voice assistants that are not easy to navigate for novice users and often require the user to decode what the perfect protocol of framing sentences and questions looks like. Companies should try, for example, to adhere to accessibility standards published by the Web Content Accessibility Guidelines (WCAG). For older adults to fully utilize smart home technology, we need to make sure they are adopting it in an informed manner. They may also be able to use it in a sustained manner once they see its value and feel confident about being in control of their data collection and where it goes. It is important that companies build their trust ethically, and to ensure that older adults are not required to trade off their privacy for autonomy and security. Design of privacy policies plays an important role and if companies designing smart products make it easier for the older adult population to understand their privacy laws and make them feel comfortable using their devices, it is estimated that the number of older adults using smart home technologies will only increase.

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05.

Design

The Need for and Importance of Considering User Experience Principles in Privacy Communications

5.1 Introduction

As the number of times we are asked to agree to various terms and conditions and sign privacy policies by checking a box digitally increases, the need for a more comprehensible and accessible presentation of these documents also increases. This chapter attempts to develop a better understanding of what people think about privacy policies in general, and explores how users interact with these documents. As part of this research, various prototypes of privacy policies are shown to participants, followed by in-depth questions about their thoughts and preferences regarding what information they find most important and would like to retain for future use, and what they look forward to learning from privacy communications and how the documents can be best optimized for that.

5.2 Methods

In this interview-based study, 10 participants came to the MIT AgeLab in-person for semi-structured interviews that lasted approximately an hour each. Participants were shown various prototypes of privacy policies that included different ways of presenting information and their preferences were noted. These preferences were followed by a set of questions; the questions and prototypes were divided in four categories: 1) Navigation, 2) Readability, 3) Presentation, and 4) Information-Hierarchy.

5.2.1 Participants

Participants were recruited from the MIT AgeLab's research volunteer database. A questionnaire for recruitment was sent out to eligible participants over the age of 50. Respondents were contacted, and 10 participants were recruited, five of whom were in the age-group of 50-64, and five of whom were age 65 or older. Two of the participants identified as male, and eight identified as female. The recruitment questionnaire contained the following questions:

1. How often do you read privacy policies or terms and conditions agreements of a smart home device or other technology you might use before you sign it?
2. Which of the following statements best describes your reading of these documents?
3. How experienced would you say you are with using various types of technology (e.g., computers/laptops, tablets, smart phones, etc.)?
4. Do you use a smartphone?
5. Do you own any smart home technology devices?
6. How many smart home devices do you own?
7. Do you own any of the following devices? Please select all that apply.
    - Amazon Alexa
    - Google Home Speaker
    - Apple HomePod
    - Smart Thermostat (e.g., Google's Nest Thermostat)
    - Smart Door Lock (e.g., Ring, August Smart Lock)
    - Smart Display (e.g., Google Home)
    - Smart Vacuum Cleaner/ Vacuum Robot (e.g. iRobot's Smart Vacuum Cleaner)
    - Smart Lights (e.g., Philips Hue Smart Lighting)
    - Smart Plugs (e.g., Eve Energy Smart Plug)
    - Smart Doorbell (e.g., Amazon's Ring Doorbell)
    - Smart Leak Detector (e.g., D-Link's Smart Water Leak Sensor Kit)
    - Smart Blinds/ Window Treatments (e.g., Yoolax's Automated Window Shades)
    - Smart Smoke/ Fire Detectors (e.g., Google's Smart Nest Protect, SimpliSafe's Smart Smoke Alarm)
    - Smart Landscaping/ Watering Systems (e.g., SmartBee's Irrigation Base System)
    - Smart Pet Systems (e.g., Tuya's Smart Pet Feeder)

5.2.2 Prototype Testing

The prototypes for the interviews were created on Figma (a software to create digital prototypes). The prototypes were created to test what navigation methods participants preferred. Other aspects that the prototypes tested included readability, information-hierarchy preferences, and presentation preferences. Other elements that were tested in the prototypes were the placements of navigation menus and the use of hyperlinks because these two elements vary in most documents, so testing these and understanding what participants prefer most will help point to what an ideal privacy policy might look like.

The prototypes were designed for A/B testing. In A/B testing, a user is presented with 2-4 design options and is asked to pick their most preferred option along with some reasoning for why they selected what

they selected. In this research, for each dimension of interest, the participant was presented with two to four privacy policy designs, from which they selected their most preferred option and discussed why they chose that, as well as why they did not prefer some options.

5.2.3 Interview Questions

The interviews began with a few warm-up questions that asked participants to briefly explain what smart home devices they currently use in their homes, describe their current living situation, their thoughts on data privacy, and whether they usually read or skim through privacy documents or user agreements. After this, the participants were shown some prototype privacy policy designs that were created for testing followed by in-depth questions about each dimension. Each section below had a couple of prototypes each that tested different features of the policy varied based on one dimension at a time. At this point in the study, many participants had already discussed some of the features included in the prototypes while talking more generally about their preferences. For them, the prototypes served as a validation as they were able to see a visual representation of the preferences they were voicing and hence could provide more detailed insights around why they preferred the option they chose from the prototypes. On the other hand, participants who did not touch upon the features studied during the initial discussion took more time to look at the prototypes and to ask questions about the features included, and the majority of the time these participants concluded by selecting one option over the others without much detailed discussion about why they chose what they did.

Navigation: This dimension was created to get insights from participants regarding the kind of navigation form they prefer to see on their ideal privacy policy. Different types of navigation options like a dropdown menu, a vertical sidebar menu, and hyperlinks with simple scroll were part of the prototypes.

Readability: Prototypes included variations in the number of columns and column width, size of paragraphs, whitespace (breathing space) around the text, contrast, typography, and font size.

Information-Hierarchy: This dimension tested if the participants cared which sections were shown first and the general order of sub-sections with respect to the importance of each to understand if there were certain preferences in terms of creating a rule where companies are required to present the information that is the least obvious first or at the top so that there is a higher chance that users will see it while skimming through the documents.

Presentation: For this dimension, participants gave feedback and shared their preferences around various features like: either showing all the information at once versus having multiple steps/layers to get to certain information in the privacy policy; distinctly highlighting certain sentences that need a user's attention; and the best way to encourage using the opt-in and opt-out settings through the policy itself.

5.3 Results

5.3.1 User Segmentation by Privacy Attitudes

During recruiting, participants were asked questions to capture their privacy attitudes and practices. Privacy attitudes and preferences of people have been studied extensively in previous research, and past

work has identified five distinct personas (Morton and Sasse 2014). Based on the research by Morton and Sasse (2014), and the data from the interviews, participants in the study were assigned one of the following personas: Fundamentalists, Lazy Experts, Technicians, Amateurs, and the Marginally Concerned. Each of the personas listed above is associated with two dimensions; the level of knowledge, and the level of motivation. Knowledge here refers to being up to date with legal matters in the policy space; general knowledge about various technologies and their offerings; knowledge to scrutinize organizations for the decisions they make regarding collection of personal information, among other things. Motivation refers to the degree to which users put privacy controls over benefits the product might offer when they compete with each other; the motivation to learn about instructions and taking the trouble to opt out of certain offerings, among other things.

Responses from the recruitment survey suggested most participants were either Fundamentalists or Lazy Experts. However, following analysis of the qualitative data collected from the interviews, while there was not a single participant who could be categorized as a Fundamentalist, there was only one participant who was identified as a Lazy Expert. Participants were assigned into each category of personas as follows:

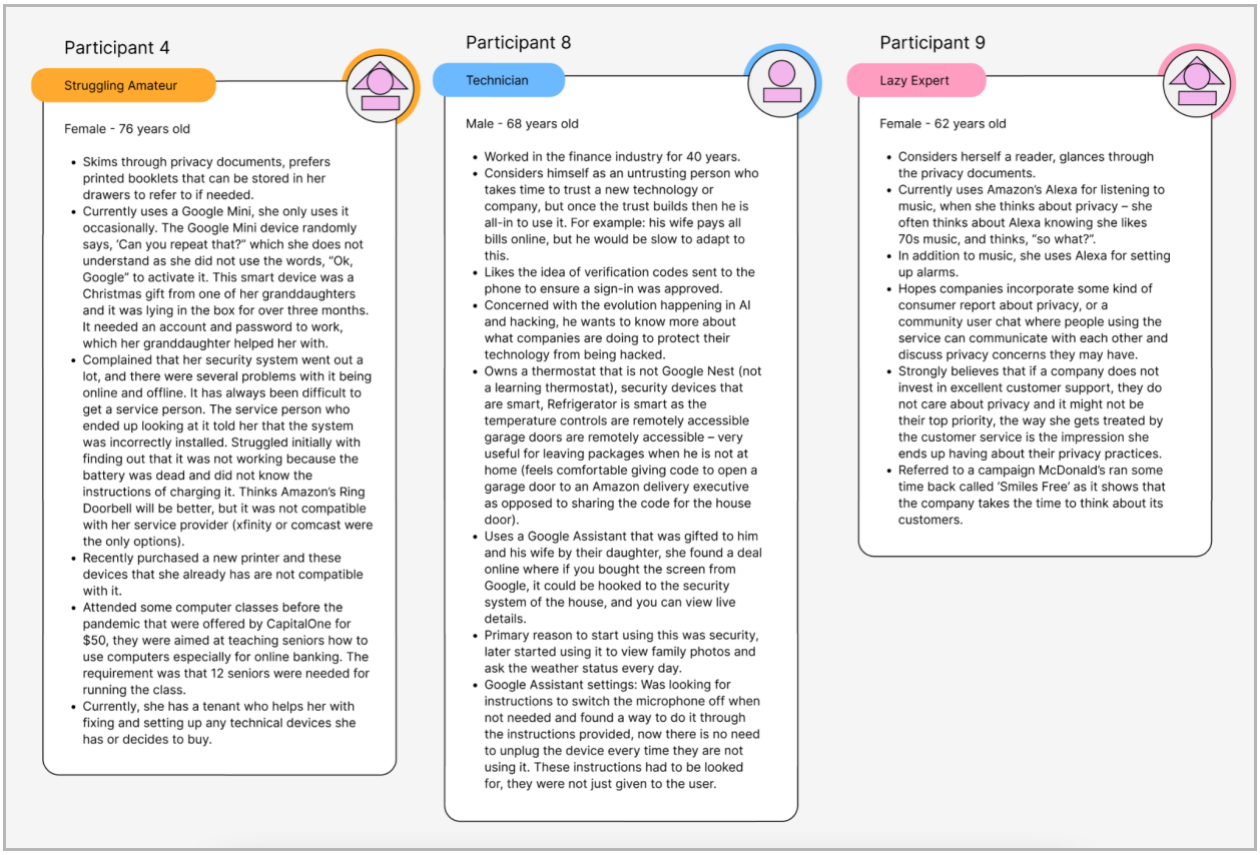
- Fundamentalists (high knowledge, high motivation): 0
- Lazy Experts (high knowledge, low motivation): 1
- Technicians (medium knowledge, high motivation): 5
- Struggling Amateurs (medium knowledge, medium motivation): 3
- Marginally Concerned (low knowledge, low motivation): 1

The high/low knowledge and high/low motivation assessments were determined from the various experiences and preferences the participants shared during the interviews. Highlights from each participant's interview have been compiled into summaries (see samples in Figure 2 below; the rest of the participants' summaries can be found in Figure 8 and Figure 9 in Appendix).

Participants who demonstrated some resistance to adopting new technology as soon as it came to the market were either completely unaware of the new technology or they were very aware and had consciously decided not to use that particular technology because of some privacy concerns among many others, these participants were considered part of the Struggling Amateurs or the Pragmatists' persona group (Table 2 from Dupree et al., 2016). Technicians, who were five out of ten participants in this sample, were highly motivated because they had somewhat stronger opinions about using smart home devices and about the data privacy practices followed by technology companies. The default settings of most smart devices were not what users hoped for. They were not, however, sufficiently knowledgeable so that they could adjust or update these privacy settings to match their preferences. Hence, the preferences they had while they shared their thoughts about various questions asked during the interview as well as during the user testing suggested a curious nature. As an example, they preferred to go to a website to view a privacy policy if they had certain questions and preferred a navigation format to be question-based hyperlinks or to begin with FAQs. This is because they would go to the privacy policy when they had a question, which was probably because they were highly motivated and curious to be correctly informed regarding the privacy practices a respective company followed. Other information preferences of technicians included being able to click on a difficult phrase and get an explanation for it. Choices of information presentation differed based on the persona of a participant, which could imply that

we have to design privacy communications customizable for different kinds of users that may exist in a product or service's user base. This will help to make it easier for people to get the information they need; doing this will be a step towards improved privacy education practices.

Figure 2 - Example of mini summaries of some participants



5.3.2 User Testing Results

The prototypes used for the user testing are described briefly in this section followed by insights and results; images of the prototypes are in the Appendix. The content from Amazon's Privacy Policy[15] has been used as in the prototypes of the privacy policies that were tested during user testing.

1. Navigation Preference: FAQs with Hyperlinks-based Navigation over Sidebar Navigation
    - Option 1 was a comprehensive document with hyperlinks at the top in the form of FAQs; this was the most preferred option among the participants.

[15] Amazon Legal Notices. Amazon's Privacy Policy: https://www.amazon.com/gp/help/customer/display.html?nodeId=GX7NJQ4ZB8MHFRNJ

- Option 2 was a document residing on a web page with a side navigation that has the different sections of the privacy policy as headings in the sidebar; this was the second most preferred option.
- Option 3 was a traditional privacy policy; none of the participants picked this as their choice.
- Option 4 was a web page with sidebar navigation and a chatbot present on the bottom-left corner that has a real name and can answer any questions one may have about the content of the privacy policy or agreement, this was the third most preferred option.

The responses in the interviews suggest that Option 1 was most engaging for participants compared to the other options. Based on the feedback gathered from the interviews, the following can be inferred::

- Questions-based navigation with hyperlinks was preferred over vertical sidebar navigation because privacy policies are often revisited when users have questions.
- It is unclear if users will spend more time on privacy communications based on the navigation format of the documents as this was not tested in the interviews.
- Users are open to interacting with chatbots to ask questions, but they preferred to call the helpline or customer service as they perceive chatbots useful for tasks like tracking orders, but not for getting help regarding qualitative questions.

Figure 3 – Prototype for 5.3.2.1(a) - Option 1

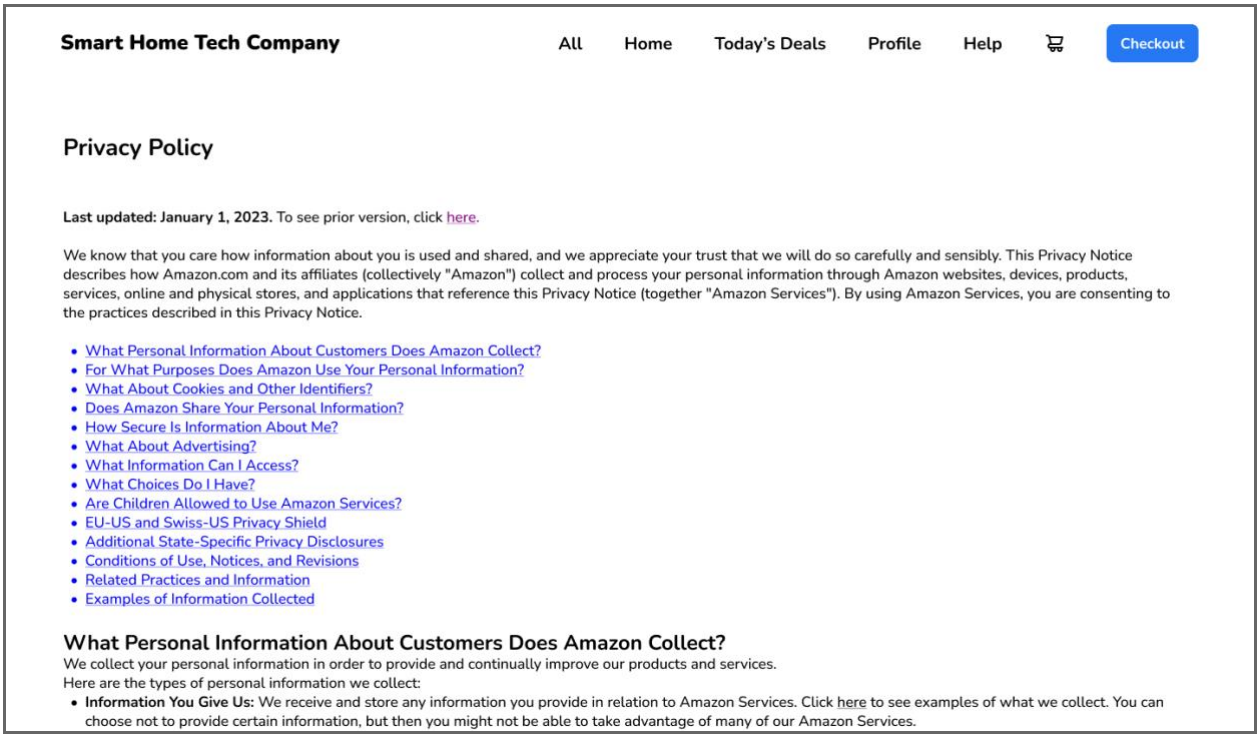
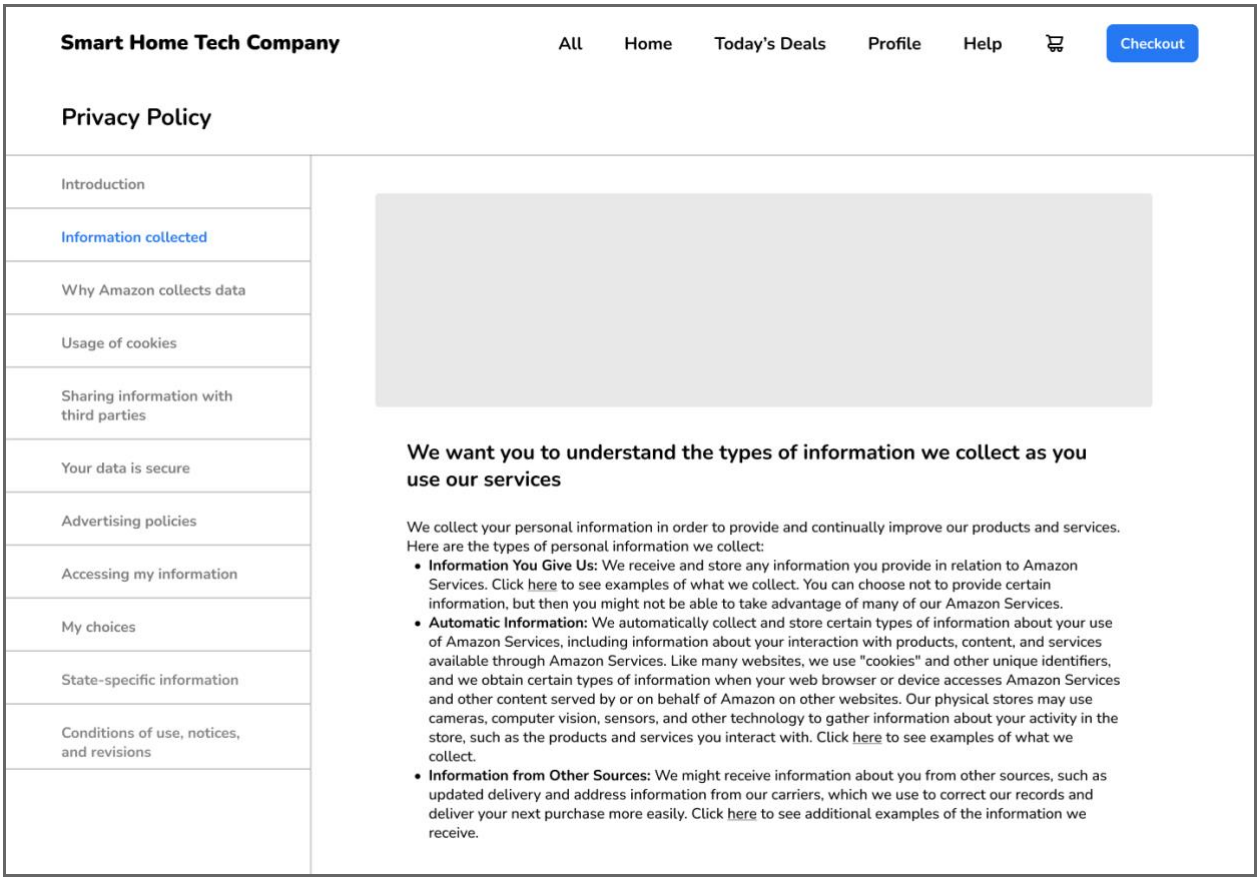


Figure 4 – Prototype for 5.3.2.1(b) - Option 2



2. Presentation Preference for Reading: Three Columns over One Column

    - Option A's layout is similar to newspaper columns; it was divided into three columns with the heads of each column at the top. The headings were bolded.
    - Option B's layout had text run across the page and the headings were bolded; there was no distinct space between the different headings on this page.

The responses in the interviews suggest that participants preferred option A over option B for multiple reasons. In Option A they could see all three headings at the same level and could decide to read further if any of them were concerning or they felt like they needed more information; the three columns make it quicker for those skimming through the content, which is the most probable case as majority users still don't read the documents in their entirety. However, even though the majority preferred the first option, it is important to note that a few participants preferred option B as they felt that it was better for reading purposes and the continuous line across the page is better for the eye and easy to read. They also mentioned not liking the unevenness of the paragraphs in option A, which could be visually unappealing.

3. Hierarchy of Information Preference: Unobvious collection of information first

Both the options were presented in a layout that had three columns:

- Option A had content in the following order: 'Information You Give Us', 'Information from Other Sources', and 'Automatic Information'. Here, the first column is the most obvious information because the user is giving it to the company voluntarily, whereas the second and third heads are not so obvious as it is information collected from other sources.
- Option B had content in the following order: 'Automatic Information', 'Information from Other Sources', and 'Information You Give Us'. Here, the automatic information is presented first so in case the user is just skimming through the document, there is a higher chance that it might catch their eye.

The responses in the interviews very distinctly and clearly favored option B, as it puts what is more important for the user first and gives priority to what needs their attention the most.

4. Clicking further for accessing specific detailed information versus displaying everything
    - Option A had a three-column layout with the headings at the top and fairly small paragraphs under each heading; there was text that mentioned the user could click on the hyperlink to get detailed examples of what kind of information is collected under that heading. The sentence, 'Click here to see examples of what we collect.' was highlighted in fluorescent green to grab the user's attention. There was no information presented regarding how the information would be presented upon clicking the links.
    - Option B had a three-column layout with the headings at the top. The paragraphs were followed by detailed examples of all the information that would be collected by default.
    - Option C had one field and multiple dropdowns; the user had to select any one dropdown option at a time and then they could view the paragraphs explaining the type of information followed by the detailed examples of what information would be collected.

The participants had a strong preference for option A, but there was s trong emphasis and voicing of opinions that it was necessary for the text 'Click here to see examples of what we collect' to be distinctly highlighted. If the text was not highlighted, most users would miss it as the majority of them just skimmed through the documents quickly. Option B was too cluttered for anyone to make sense of, so they did not prefer it; it was overwhelming to look at so much information at once. Many participants thought that option C was acceptable, but it was less preferred because it required too many clicks to cover all the information. Everyone is in a hurry when they skim through such documents, and the interviewees' opinion was that if users are required to click so many different options they will end up skipping the content altogether. For option A, they also preferred having a pop-up appear that displayed the examples of information collected for the respective sub-type that was clicked on.

Figure 5 - Prototype for 5.3.2.4(a) - Option A

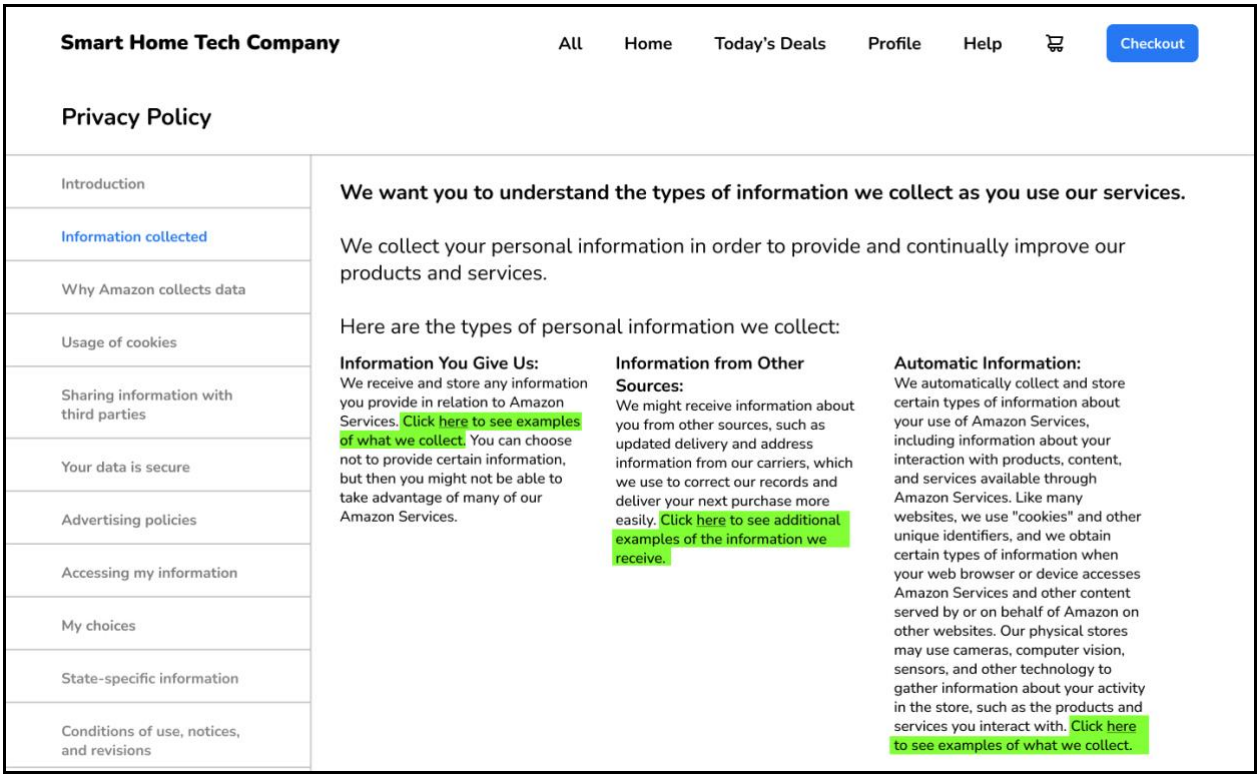
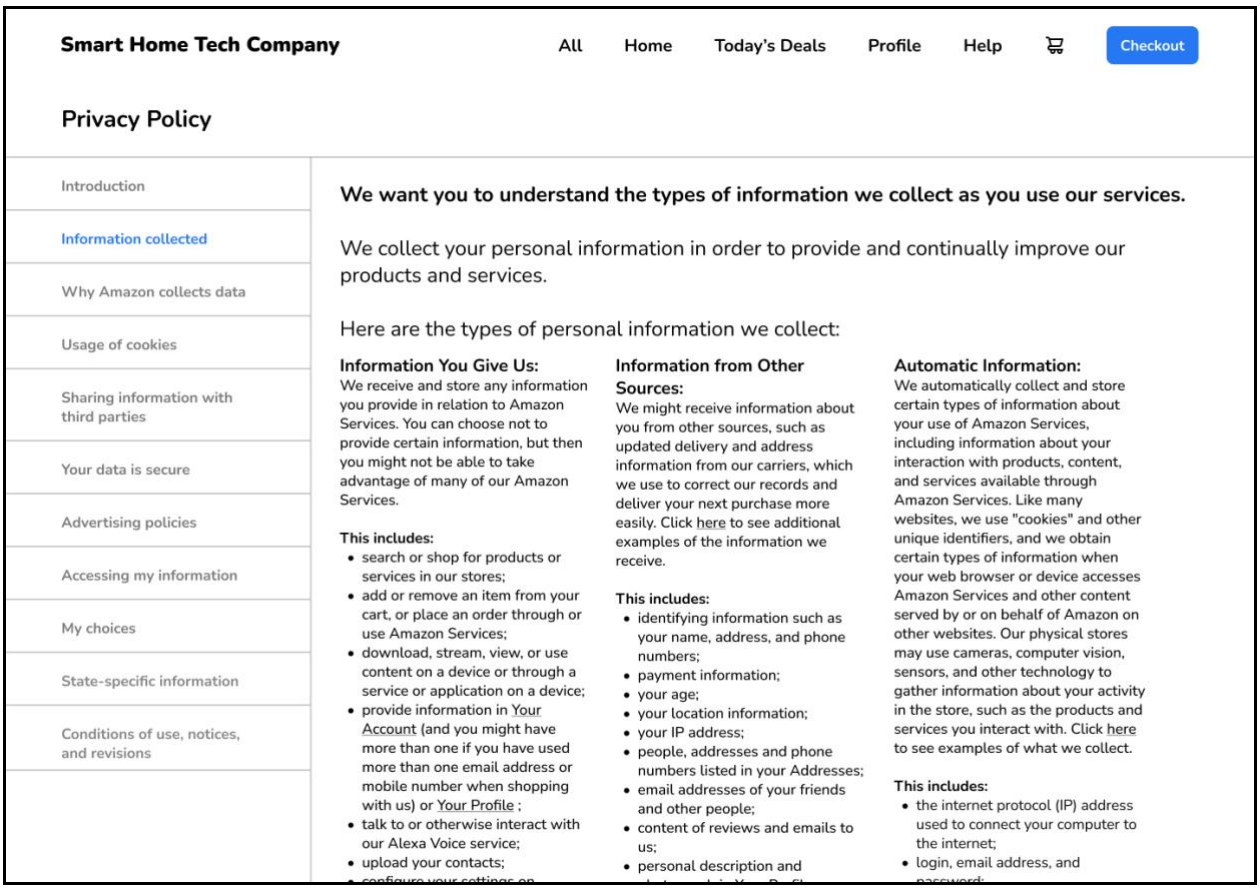


Figure 6 - Prototype for 5.3.2.4(b) - Option B



5. Easy and understandable interface design to support the ability to change settings quickly
    - Option A had all the information displayed at once, with the different types of data that are collected under various subtypes of information, and some highlighted text mentioning that users could decide not to provide certain types of information but would lose access to certain services. There was no further information provided on how they could opt-out of providing the information, though.
    - Option B also had all the information displayed at once, but each example of the information under the subtype had a checkbox that was already selected. The text mentioning that users could decide not to provide certain types of information but would lose access to certain services was still present. It was obvious regarding how the opt-out would work, as the checkbox is a well-known component across interfaces, and a user could just click on the information they did not wish to share.

In this section of the interview, all 10 of the participants preferred option B with the checkboxes and an easy to understand and opt-out design. Some suggested that if a user unchecked a box, there should be an alert that informs them about the services or features they may lose access to which would enable them to weigh whether the trade-off was worth it or not. Some participants suggested that only the minimum

required data to use the product or service should be checked for by default, and the user could give out more information if they wanted to in return for bonus features and services, essentially advocating for an opt-in model instead of opt-out model.

5.3.3 Key Themes Emerging from the Interviews

- Use of analogies and metaphors was encouraged, simple explanations were considered to be extremely powerful

  Interviews revealed that using analogies and metaphors made it much easier for participants to understand complex scenarios that were explained in privacy policies and currently included the use of legalese. Many participants look for information booklets to get help about certain issues they might be facing; while some mentioned looking for a **'?'** (question mark) on the website that represents help as users often thought that clicking on the question mark would direct them to a chatbot/ a set of FAQs/ a helpline number.

  Through the discussions, it was clear that many participants often copy-pasted a phrase that is difficult to understand into a search engine, and reading these answers seemed to be a go-to strategy for most participants when they wanted to know what the simplified version of a legal and extremely technical phrase was, whereas some participants suggested having a built-in dictionary that one can access upon hovering over the word or phrase. Participants also suggested that adding crowd-sourcing data about how many users opted-out of a particular data sharing aspect could be useful to help people decide what they should do, and it would also make them reflect on whether they really needed a particular feature or not if X number of people had opted-out of it. Interviewees also agreed that scenarios would be helpful to explain what can go wrong, and what steps to take if found in that situation (e.g., a list of FAQs about what can go wrong). and how to respond). There were also some concerns over companies making blanket statements about requiring access to certain personal data without explaining why they would need this kind of data to provide their service. As one participant noted:

  > *P6: The other day, I was trying to use a new app I downloaded on my phone. While I was onboarding, it asked me for access to my contacts list. Why would it need that?! It did not give me a reason for needing this information either, so I did not consent to it and decided to delete the app. I will not consent to such asks unless I absolutely need to use the service or product,; this was not a necessity for me. I wish companies provided more information regarding what they do with the data they collect about users. I mean, what if the app sent messages to my friends on its own if it has access to their contact numbers?* (Female, 62-year-old smart home user)

- Actionable steps to manage and control the data they share with the companies and the need for high-level summaries

  Privacy policies were revisited by users for various reasons based on their personalities, but the current design of such policies was found to be rigid as it does not accommodate the different needs of each persona groups that have been discussed earlier in this chapter. Participants

described digging in the privacy policy for a considerable amount of time before they could get any information regarding controlling sharing personal information. Steps to limit targeted advertisements were discussed by almost each of the interviewees, as most companies shared personal activity related information with third-parties when it came to discussing the nature of the actionable steps they were looking for. One participant described his experiences as follows:

> *P8: We were given a smart home device called 'Google Nest' by our daughter not too long ago. I don't trust it fully yet, but my wife has been all in. We initially got it just for being able to get a live view of our security cameras, but now she stores family photos that keep showing up in a random order on it, asks it questions about the weather, etc. What if it was listening to us all the time? I dug into the instruction manual and figured out how to switch it off when not in use without unplugging it, [because] until then, we were unplugging it every time it was not in use. This information was not easily accessible because there were no actionable steps anywhere, companies should make it easy for users to understand how to have control over data sharing.* (Male, 76-year-old smart home user)

- Innovative and creative ways of presenting privacy policies and user agreements were greeted enthusiastically

The participants voiced opinions on being able to change the font of a privacy policy as the length implies that it is almost like a book that needs to be read, and many people have preferences about what font they are comfortable reading. Responsive text, contrast, and legibility on smaller screens were highlighted too as options that should be customizable. Some alternative ways of presenting the privacy communications to users that were brought up by participants during the interviews included:

- A government initiative that rates companies' data privacy policies: If there exists a government data privacy committee, the privacy ratings generated by the committee can be displayed in the form of a star-rating that most products on eCommerce websites have, and these can be made publicly available. This could encourage companies to ensure they provide good support regarding privacy-related issues.
- Offering various privacy packages: A concise way of presenting privacy options to users could be achieved by referencing different kinds of pre-filled choices (opted-in or opted-out) that they can select from based on their needs and whether they see themselves as basic or advanced users of the product or service they are signing up for. This format will potentially help users to make more informed choices quickly.
- A participant noted the U.S. Security and Exchange Commission's (SEC) efforts to make it easy for the general public to understand government documents through the launch of the Plain Writing Act of 2010 (Act) that provides guidelines in the form of a handbook for lawyers and others contributing to these documents to be able to write certain sections

in plain English and avoid the use of legalese.[16] The guidelines provided in this document apply to legal documents like financial disclosures. If these are applied to data privacy related documents, it will be a huge step towards more comprehensible to ordinary consumers.

- Reducing the learning curve by standardization and leveraging existing models

  If we leverage existing mental models that users have, we can encourage people to focus on the information presented instead of learning new ways to navigate the document. For example, standardization of privacy policies would be an important step toward reducing the cognitive load of having to read every policy. Only the content that differs for a particular company's privacy policy from the standardized version could be highlighted at the top, as this might be something users want to know about. Currently, if a user must change the settings related to data sharing in a product or service, they first have to figure out where the instructions are, which are typically present in either dense information booklets or privacy policies. Other common settings like navigation menus, footers on the main page, or the provision of different tabs to enable users to switch between content rather than having to do a long scroll follow common patterns across different websites, so familiarity with these would make it easier to navigate a new website. Further, if existing mental models are leveraged in the design of the technologies themselves and their interfaces to allow users to make changes to the default privacy settings, users may feel like they are more in control of who has access to their data, what data is collected, where it is stored, and how long it is stored for. As one interviewee said:

  > *P10: It would be ideal if the government released **one** single standardized privacy policy that does not change from company-to-company. People would read it once and sign it, after this, every time a company asks for consent, they just need to highlight how and if their practices differ from the standard set by the government. And more importantly, why it differs. It is not practical to expect us to read and understand 20-30 pages of legalese almost two or three times a week.* (Female, 74-year-old smart home user)

A good number of interview responses were closely aligned with some general guidelines and laws in user experience design[17,18] that highlight the advantages to users if they were followed while creating digital experiences conveying information regarding privacy. Through the data collected from the interviews, it was evident that many of the guidelines and laws have been violated when considering how privacy communications should be delivered to the customer or user. Some of these laws along with their relevance in privacy communications have been listed in Appendix A.

[16] Office of Investor Education and Assistance (U.S. Securities and Exchange Commission). (n.d.). A Plain English Handbook: How to create clear SEC disclosure documents. Retrieved May 8, 2023, from https://www.sec.gov/pdf/handbook.pdf

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5.4 Conclusion

The results from the interviews emphasize that it is important to consider UX design when designing or creating legal or binding documents like privacy policies and user agreements. Interestingly, there were no obvious differences in preferences for privacy policy design features between the two age groups. The following aspects of the design were strongly preferred by most users from the prototypes; these could also be used as guidelines for the future design of privacy communications:

1. Concise summaries at the beginning of the document that highlight the most important content from the policies must be present in every privacy policy.

2. The policy's navigation should be question-based or have a list of FAQs because most users revisit privacy policies if they have certain questions or concerns or find themselves in a particular scenario that needs additional clarification.

3. Text that points the user to another page or pop-up to access more detailed information regarding certain points must be highlighted distinctly so that it is not missed.

4. Because privacy policies are often long, an option to change the contrast, font, and font size will make the documents more user-friendly.

5. Companies should create privacy education content in alternative media to encourage people to understand the implications of signing the privacy policy; this will greatly help visual learners and those who do not generally read such policies.

6. The legal terms in the privacy policy and user agreements should be simplified so that everyone can attempt to understand them, hyperlinks or dictionary-like features should be implemented for phrases that are tough for people that come from fields other than the legal industry.

7. Grey text on white background should be discouraged as it is not accessible to those with low vision; further, grey text on a white background does not meet the WCAG standards.

8. Emails or communications informing users of updates made to privacy policies that have already been signed should include an overview of what has changed along with reasons for making the changes.

9. Companies should be willing to give users a considerable amount of time to go through the documents, instead of asking them to agree to the terms and conditions and sign immediately. Alternatively, an option to revoke the action of signing an agreement should be present, assuming the user goes through the terms and conditions later and decides that they do not in fact agree with the presented terms and conditions.

10. A star rating based on user reviews about how they rate the privacy practices of a particular technology company based on experience using their products and services should be presented to the user, along with some statistics on the number of users who opted out or opted in of certain optional features that are offered by the company.

11. Availability of customer service or a live chatbot to assist with questions users may have at the time of signing or later when they revisit the privacy policy would be a good addition to the current offerings.

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06.

Conclusion

6.1 Introduction

As we continue to bring new devices into our homes, we allow technology companies to collect more and more data about us. With each new device or service that we use, we are implicitly or explicitly consenting to companies collecting and storing data about us by signing their privacy policies by accepting the terms and conditions that say, ***"I have read and understand the above terms and conditions"***. But how many of us really read them and understand the implications signing such documents may have for us?

At the beginning of this research, one hypothesis was that there is a need to redesign the privacy policies and user agreements if we want older adults to understand the content presented to them in these documents. The evaluation of existing privacy policies made it clear that such policies were not written in a language or format made to be understood by an ordinary person, and in-person interviews with older adults made it very clear that a majority did not read privacy communications that came their way. Reimagining the way policies are presented today is essential if we want older adults to read and ideally to comprehend the documents. A second hypothesis was that if older adults adopt technologies in an informed manner through a better understanding of the content and are able to take control of their data, they will be more comfortable using smart home technologies, which may allow them to age-in-place. A mixed-methods study with the MIT AgeLab's 85+ Lifestyle Leaders' Panel that included a questionnaire and virtual and in-person focus groups revealed that a majority of the older adults who participated are not wholly comfortable with the technologies they currently use, that their level of comfort varied by

person as well as the technology in consideration, and that informed adoption could have a positive impact on their comfort level with these technologies. During discussions, most participants voiced interest in wanting to take control of the data they share, but they were unaware or uncertain of how to do so, as this information is present in privacy policies and mobile applications, both of which these older adults were not extremely fluent with.

6.2. Key Results: Revisiting the Initial Research Questions

1. ***Examine the content in the privacy policies and user agreement and determine better ways to present this to the users through user testing.***

   → Older adults voiced strong preferences regarding the presentation of documents. While a specific presentation of these documents cannot ensure comprehension, it was evident through the in-person interview study that if technology companies apply user experience design principles to privacy communications, older adults will find them more appealing and will be more likely to consider reading these documents. Regardless of understanding of a company's data privacy practices, however, older adults said that they would be willing to use one or many smart home devices if they were in a situation where the only other alternative was to move out of their homes.

2. ***What do users think of the privacy policies and user agreements made by companies and their importance? How do users generally read them?***

   → Many users felt that privacy policy documents were not so important because they were not the ones to sign and agree to the terms and conditions of these documents. Smart home devices were generally gifted to the older adults by family, who then signed the privacy documents and user agreements as a part of the process while doing the initial set-up for them. Everyone who participated in the various studies throughout the research was aware of privacy policies and user agreements, but most did not specifically think about them as important because they had no other option but to sign such policies if they wanted to use a specific company's product or service. While some of them neither read nor considered the privacy policy documents important, a majority of them did not use smart home devices regularly due to concerns such as not knowing how to use the controls to switch off a smart assistant when not in use, for example. This information is present in the documents. Anecdotes shared by participants highlight the importance of reading privacy communications, however, as a lot of the information they desired in order to have better control of the devices is all in the documents.

   → Surveys, focus groups, virtual focus groups, and in-person interviews - all of these empirical data pointed toward older adults not really attempting to read these policy and user agreement documents, with only a small percentage of participants reporting skimming through them. Adding summaries, bullet points, an ability to manipulate font size and contrast, making them more concise and shorter in length, and using simpler language were some changes that would encourage participants to read the privacy communications that were presented to them.

3. ***What changes might we make to the current design of privacy communications so that we ensure comprehension and prioritize user understanding?***

   → The results from this thesis suggest that a first step towards privacy communications that ensure comprehension and prioritize user understanding is to design them keeping the best interests of the users in mind. The way many of these documents are designed today is to get the users to sign and accept the terms and conditions by checking a box. Design of privacy communications often make it difficult to discern essential data that might be useful for users to know in order to have a better control of their data. The language used is often designed best to be read by people with a legal background, as this might ensure that the companies are legally protected if they sell personal data to third parties or face data breaches or other data leaks. Through in-person user testing and interviews, Chapter 5 brings multiple user experience guidelines and principles to light that should be incorporated in the design of privacy communications. The relevance of the WCAG guidelines was also validated from discussions during the interviews.

6.3. Discussion

- Improved user experience design of privacy communications may not be directly proportional to an increased user interest in reading

  Even if technology companies create privacy policies that are user-friendly, it is uncertain if older adults will be interested in reading these communication documents. It will be helpful to explore and find out how much time older adults spend on different sections of a privacy policy that is created with the help of user experience design guidelines and as per the guidelines mentioned earlier in this thesis. Previous studies show that shorter and more concise communication does not automatically guarantee a user's comprehension of the content presented to them in privacy policies (Korunovska et al., 2020).

- Interactive involvement improves user understanding

  One theme that emerged in the in-person interviews was the availability of various media in which privacy education can be done. It will therefore be interesting to explore media like audio podcasts that are personalized to users' interests or visual videos that might be available on YouTube or other similar video streaming channels for users who prefer visual media. A good number of older adults who participated in the studies preferred to talk to a real person if they had questions regarding data privacy, but they were open to being educated by the customer service team by telephone regarding various aspects of data privacy, as a lot of them liked the idea of having a conversation to resolve any doubts or problems they might face.

- Effect of increased understanding of privacy communications on smart home technology adoption rates

  It will be interesting to find out if an increased understanding of privacy policies and user agreements among older adults eventually leads to an increased adoption of smart home technologies over sustained periods of time. Burrows et al. (2018) encourage technology creators to think about various ways in which users can be motivated to have ownership of the data that is collected by the devices they own, as they believe this should get people to care about what happens to this data, which will in turn support measures aimed at mitigating the risk of data misuse. This study highlighted that smart home technologies should create mechanisms that allow users to control their own data generated by the devices they install (Burrows et al., 2018).

- Reimagining the way consent is collected

  A paper by the World Economic Forum (2020) reimagined the way notice is given and consent is granted through the lens of human-technology interaction. They suggested various ideas that could be explored to improve the way notice and consent collection is happening today. This thesis tested some of these ideas, notably around how older adults react to different layouts and navigation formats of privacy communications, their preferences around opt-in and opt-out models, and different styles of layouts based on information-hierarchy. It was clear from the responses from various questionnaires, focus groups, and interviews that there is a need to reimagine the way consent is collected by technology companies today.

- Usability and reliability of smart home devices

  Through discussions with participants, the general sense was that most of them believed that people would rely on systems and technology in critical life saving situations like calling an emergency helpline or informing their children regarding a fall, and mentioned serious concerns about the reliability of technological devices whether smart or not. Voice assistants can prove to be an extremely useful tool as interacting with them does not require any interaction with eyes and screens. Consistent with Kim's (2021) work, results from this research suggest that the design of current smart home devices needs some modifications if older adults are expected to use them flawlessly.

- Aging-in-place or the 'ageless' home

  There are multiple such smart home technologies currently available in the market like smart blinds, smart thermostats, smart lighting systems, and smart locks, to name a few, that can help

with managing a house. Companies manufacturing smart home technologies should consider providing support to older adults through informational documentation of successful operation protocols, so that the attempt to use these devices does not end up being hit or miss, but instead aims to encourage sustained use that can help them age-in-place for as long as possible. As two research participants noted:

> *P2: Many people I know cannot afford to go to these retirement communities. I was living in an independent apartment near my daughter and she would be concerned about what would happen if she was away and she travels a lot. The neighbors would call me to see if I was alright. I did not like that, that was becoming a hassle for her, that is why I decided to move to independent living in a community. It would have been possible that [if] somebody else could have done, monitor my health, smart devices, I could have stayed there for longer.* (Female, smartphone user)

> *P4: I would use technology only if this was the only, way I could stay in my home. If I can stay at home using technology or go to the nursing home, I would opt for technology. But it depends on what ails you; there could be complications where no technology may work. For some easy problems, technology will work.* (Female, smartphone user)

- Need for policy-level changes

  It is important to note that the majority of the companies create privacy policies because they are required to do so by law, or else they will face legal charges and lawsuits. If we want technology companies to consider user experience design principles and the WCAG principles that put accessibility at the forefront, there needs to be a law or change at the policy level demanding that companies follow these guidelines and design for comprehension rather than just for checking the box. The Plain Writing Act of 2010 can be used as a reference for encouraging policy level changes.

6.4. Limitations and Recommendations for Future Work

The conclusions of this thesis are based on various qualitative analyses that included a relatively small sample size that was not representative. These conclusions might differ if a more diverse cohort of older adults, in terms of demographics and previous professional and technology experience, was used. Future work may include exploring the various legal requirements and considerations that privacy communications are subject to, which were not in scope for this study. Other future work opportunities include exploring the role artificial intelligence and large language models may potentially play in the future of privacy communications, fundamentally understanding how older adults interact with technologies and interfaces to help us design these communications better, and observing the similarities in the way consent is obtained from other industries and import some of these practices into the technology space.

In closing, privacy has been historically traded off for maintaining autonomy, convenience, and better security as older adults decide which technologies to use and consent to. Improving data privacy communications in smart home technologies has the potential to mitigate poor technology adoption rates among older adults and better manage the amount and level of privacy trade-offs older adults have to make because they are left with no other option. The challenge of focusing on and ensuring ***informed and sustained*** technology adoption to help older adults age-in-place is the responsibility of everyone involved in the system; including creators of smart home technologies; data scientists who define what data might be collected and how it is stored; information designers who work on what information goes into the instruction booklets made for each technology; marketing teams that advertise the product, and even the user experience designers and lawyers who work on the privacy communication documents.

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07.

Appendix

Appendix A

Discussion Guide used for the study in Chapter 4

Group 1, 2: Don't own any smart devices
(approximately 6-7 participants are expected to be part of this group)

1:45 to 1:50 pm
Introductions of everyone present in the group.
"Tell us your name, where you are today, and your favorite ice-cream flavor"

1:50 to 1:52 pm
We will be covering this in the introduction section, in the slides we will clarify what the definitions of smart home devices, data, and data privacy are for the purposes of the workshop. But if this particular focus group needs more clarification - we could go over it again if required

> In the following discussion, we refer to 'smart' devices as any device in the house that is connected to the internet (laptops, smartphones, etc.), and/ or connected to other devices in the house (Amazon Alexa, Google Home, Apple HomePod, etc.). Sometimes, such devices can be made to perform tasks based on your habits or automated to perform tasks at particular times.

1:52 to 2:00 pm
Part A:
(This is an introduction and warm up part, and answers in less than 2 sentences are encouraged. No paragraphs or elaborate comments)

1. Is there a particular reason why you do not own smart home technology devices?

2:00 to 2:12 pm

Part B:

1. What are your thoughts on voice assistants listening to your conversations? Do you believe that they listen to everything you might speak in your home?
2. Tell us more about any fears or concerns you might have about smart technologies like voice assistants stealing your personal information.

    Follow-up question:

    a. If yes, what kind of information do you fear they will steal? In other words, are you concerned that the company has access to details like your wake-up time, medication time, etc. or do you fear them having access to your credit card details that might allow the assistant to make unauthorized purchases?
3. What are your thoughts on the capability of technology today to allow you to live in your home for longer? In other words, do you think technology that would delay the move to a care facility or assisted living by allowing you to maintain the same level of autonomy exists today?

2:13 to 2:25 pm

Part C:

1. How would you interpret this? *'Using smart technology is a trade-off between autonomy and privacy'*

    Follow-up question:

    a. Do you consider the use of technology that helps you maintain your autonomy is equivalent to trading-off your privacy?
    b. What would you consider if you were making a decision about whether to continue to live in your home independently by adopting additional smart home technology?
2. Have you kept smart home devices that are in completely good working condition in storage, drawers, etc. because you don't use them anymore?

    Follow-up questions

    a. If yes, what are some of the reasons?
3. Could you describe how you would go about making changes to the default privacy settings of a smart home device - examples of changes are what data the company collects and for how long they store it, etc.Could you describe how you would go about making changes to the default privacy settings of a smart home device - examples of changes are what data the company collects and for how long they store it, etc.
4. Do you currently use any technology in your home that has motion sensing or surveillance capabilities? If so, would you define this technology as 'smart'?
5. Do you consider the Do-it-Yourself (DIY) set-up a barrier to adopting smart home technology?

    Potential follow-up questions:

    a. What are your thoughts on adopting such technology if someone (either from the manufacturer's side or family or a third party) helped you with the setup?)

Group 3, 4: Own smart devices but don't read the privacy agreements or user agreements

(approximately 16 participants are expected to be part of this group, so the plan is to divide them into two groups)

1:45 to 1:50 pm
Introductions of everyone present in the group.
"Tell us your name, where you are today, and your favorite ice-cream flavor"

We will be covering this in the introduction section, in the slides we will clarify what the definitions of smart home devices, data, and data privacy are for the purposes of the workshop. But if this particular focus group needs more clarification - we could go over it again if required

From the survey responses, we saw that we don't generally read the privacy policies and user agreements of smart home devices. We wanted to use the next 30-40 minutes around gathering your thoughts around smart home devices and your experiences with their data collection practices.

1:52 to 2:00 pm
Part A:

1. Even though you may not be reading the privacy policies and user agreements, do you know how and where these documents can be accessed from?
2. Do you generally read a physical printed paper that requires your signature? What are your thoughts on digital vs physical signatures?

2:00 to 2:12 pm
Part B:

1. What are your thoughts on voice assistants listening to your conversations? Do you believe that they listen to everything you might speak in your home?
2. Could you tell us about a time you might have changed the default privacy settings of a smart device you currently use or used in the past, how was the experience? Did you face any hurdles?
3. We noticed through the RSVP form that you generally don't read the privacy policies and user agreements that come with the smart devices. Could you elaborate on the reason why you chose not to read these documents?
4. What would motivate you to read these documents before you sign them?

2:13 to 2:25 pm
Part C:

1. ***(answer in one sentence)***
   Did you know that except the Apple HomePod Mini, all the smart speakers and voice assistants available in the market store the voice recordings that they collect from the users for various purposes?
2. Did you know that you could make changes to the privacy settings that decide what data the company collects and for how long they store it?
   a. Follow-up questions:
   b. Have you ever modified or attempted to modify the privacy policy of a smart device you own?

3. When it comes to using voice assistants, have you ever changed or tried to change the original wake word? ZZ

    Follow-up questions

    a. Why? How did you know where to look for being able to change the wake word?
4. Have you kept smart home devices that are in completely good working condition in storage, drawers, etc. because you don't use them anymore?

    Follow-up questions

    a. If yes, what are some of the reasons?

Group 5, 6 : Own smart devices and read the privacy agreements and user agreements
(approximately 3-4 participants are expected to be part of this group)

1:45 to 1:50 pm
Introductions of everyone present in the group.
"Tell us your name, where you are today, and your favorite ice-cream flavor"

1:50 to 1:52 pm
We will be covering this in the introduction section, in the slides we will clarify what the definitions of smart home devices, data, and data privacy are for the purposes of the workshop. But if this particular focus group needs more clarification - we could go over it again if required

We see that you have read privacy policies and user agreements in the past for smart home devices or voice assistants, or other technologies. Today we will spend some time on learning more about your experience with reading such documents.

1:52 to 2:00 pm
Part A:

1. ***(answer in one sentence)***
   We noticed that you all mentioned you read the privacy policies and user agreements you sign. How often do you read a privacy policy or user agreement of a smart home device you sign?
2. ***(answer in one sentence)***
   What device do you generally read these policies and agreements on? (e.g. tablet, smartphone, laptop, desktop, etc.)
3. ***(answer in one sentence)***
   Do you read any privacy policies or user agreements for devices or services that are not in the smart home technology space?

2:00 to 2:12 pm
Part B:

1. What are your thoughts on voice assistants listening to your conversations? Do you believe that they listen to everything you might speak in your home?
2. Could you tell us about a time you might have changed the default privacy settings of a smart device you currently use or used in the past, how was the experience? Did you face any hurdles?

3. Has there been an instance where you read a privacy policy or terms and conditions agreement and decided not to use that particular smart home device?
4. ***(answer in one sentence)***
   Do you feel comfortable using the smart home devices you have after reading these data privacy policies and agreements companies have with you?
5. What does comfort using smart home technologies mean to you?
6. What changes would you suggest to the company's current policies if you wanted to be comfortable using their technologies?
7. Have you kept smart home devices that are in completely good working condition in storage, drawers, etc. because you don't use them anymore?
   Follow-up questions
   a. If yes, what are some of the reasons?

2:13 to 2:25 pm

Part C:

1. When it comes to using voice assistants, have you ever changed or tried to change the original wake word?
   Follow-up questions:
   a. Can you tell us more about why you did or did not consider doing this?
   b. If you did, how did you know where to look for being able to change the wake word?
2. Do you look for anything in particular or any specific sections in these agreements?
3. Have you seen or come across an email that mentions updates to the privacy policies or user agreements you have already signed?
   a. If yes, do you read the policies and agreements again to understand what has changed?
4. ***(answer in one sentence)***
   Would you prefer reading printed documents or online?
5. If you were presented with a printed document would you prefer fewer pages with a smaller text size, or would you prefer larger text and more number of pages?
6. How much of the content presented in the documents are you able to comprehend?

Appendix B

Questions in Chapter 5

Navigation

1. Are there any specific features you would like to see added to the navigation of privacy policies to make them easier to use and understand?
2. Have you ever had trouble navigating a privacy policy on a mobile device? If so, what changes would you suggest to make it more mobile-friendly?
3. Is there anything else you think could be done to make the navigation of privacy policies more user-friendly and intuitive?

4. How much time are you willing to spend navigating a privacy policy to find the information you need?
5. Do you prefer a menu-based navigation system, or do you prefer to navigate through a privacy policy by scrolling?
6. Have you ever had trouble finding information in a privacy policy? If so, what type of navigation changes would you suggest to make it easier to find information?
7. Do you find it helpful when a privacy policy has a table of contents or index to help you navigate the content?

Readability

1. Do you find privacy policies easy to read and understand? If not, what parts are difficult for you to understand?
2. Do you prefer a privacy policy that is written in a more formal tone or one that is written in a more conversational tone?
3. Are there any specific terms or jargon used in privacy policies that you find difficult to understand?
4. Would you prefer a privacy policy that uses examples or scenarios to help explain how data is collected and used?
5. Have you ever had trouble understanding how your data is collected or used in a privacy policy? If so, what changes would you suggest to make it easier to understand?
6. How important is it to you to know what data is being collected and how it is being used?
7. Would you prefer a privacy policy that is shorter and more concise, or one that provides more detailed information?

Presentation

1. Would you prefer a privacy policy to be presented as a pop-up or as a separate page on a website or app?
2. Are there any specific design features of presentation styles that you find appealing or unappealing in privacy policies?
3. Would you prefer to be notified of updates to a privacy policy, and if so, how would you like to be notified?
4. How important is it to you to have a privacy policy that is easy to print or save for future reference?

Information-Hierarchy

1. Do you prefer a privacy policy that is organized by topic, such as data collection, data sharing, and data retention, or by type of data, such as personal information, payment information, and user-generated content?
2. Are there any specific sections of a privacy policy that you find most important to read? If so, what are they?
3. Would you prefer a privacy policy that uses bullet points or numbered lists to help organize information?
4. Would you prefer a privacy policy that includes a summary section at the beginning to provide an overview of the key points?
5. Is there anything else you think could be done to improve the hierarchy of information in privacy policies and make them easier to understand and navigate?

Appendix C

Responses from Interviews in Chapter 5

Table 7 - Question 1 from the Navigation Section

Would you prefer a privacy policy to be broken down into sections, or do you prefer a single, comprehensive document?	
P1	Hyperlinks with table of contents, highlight where the settings can be changed, where is the information regarding the changes the consumer can make.
P2	Sections should be present at the top of the privacy policy.
P3	Having everything that matters on the first page will be ideal.
P4	Sections.
P5	Sections with FAQs.
P6	Sections, question-based.
P7	One document with different chapters (like a book).
P8	Does not read comprehensive documents any longer. Should be a simple outline with hyperlinks (clicks).
P9	Changes her settings in the MacBook Pro.
P10	Broken down into sections.

Table 8 - Question 2 from the Navigation Section

Are there any specific features you would like to see added to the navigation of privacy policies to make them easier to use and understand?	
P2	Bolding the text that needs attention is important. Clearly mentioning where the customer should pay attention, with some hyperlinks providing detailed information.

P3	Can companies make a shorter document and include everything that might matter to a consumer in it?
P4	Visual learner, would prefer learning about the contents in a privacy document through YouTube videos. Prefers to talk to someone to understand usage related information.
P6	Sections, no scrolling should be involved.
P7	Clearer language will be better, and is okay with reading. Features should have a theme of opt-in instead of opt-out.
P8	Click on the heading and get more information.
P10	Hyperlinks and third party related information. How they are selling data to third parties is important to know.

Table 9 - Question 3 from the Navigation Section

How important is it to you to be able to quickly find specific information in a privacy policy, such as what data is collected or how it is shared? Have you ever had trouble finding information in a privacy policy? If so, what type of navigation changes would you suggest making it easier to find information?	
P1	Very important, hates searching for information and is not sure of what terminology to look for while searching since it is in all extremely legal language.
P2	Search online in the PDF, or a good to have feature would be like that of Kindle, where a user can click on the word they don't understand, and a dictionary snapshot of its meaning is provided in a pop-up. Kindle reference, dictionary gets activated upon clicking on a word, if there was similar functionality in privacy related documents that are extremely legal, I will be easier for laymen to understand. Likes to see one thing at a time, the newspaper style layout was too much happening at once.
P3	Google terms that are not known and search for the meaning. Kindle/ Dictionary features might be nice.
P7	Was of the opinion that if customers read the whole thing, they will be able to quickly find what they need.
P8	Ctrl + F to search the document for the word.
P10	Ctrl + F or Spotlight Search

Table 10 - Question 4 from the Navigation Section

Have you ever had trouble navigating a privacy policy on a mobile device? If so, what changes would you suggest making it more mobile-friendly?	
P1	The document needs to be fully functional on a mobile phone. If the intent is for the user to just accept the terms and conditions and tick the checkbox, it should be placed on the top and all the scrolling should be avoided. Change the font type and font size for accommodating low vision, contrast, and cognitive disabilities.
P2	Yes, they need signs. The font size needs to be bigger, a greater number of pages are fine but the font needs to be big.

Have you ever had trouble navigating a privacy policy on a mobile device? If so, what changes would you suggest making it more mobile-friendly?	
P1	The document needs to be fully functional on a mobile phone. If the intent is for the user to just accept the terms and conditions and tick the checkbox, it should be placed on the top and all the scrolling should be avoided. Change the font type and font size for accommodating low vision, contrast, and cognitive disabilities.
P2	Yes, they need signs. The font size needs to be bigger, a greater number of pages are fine but the font needs to be big.
P4	If there is trouble they would prefer to call people, but just chatbots are talking on the phone asking customers to press 1,2,3 or 4 and it is very difficult to get someone on the line for help.
P5	If finds it difficult, leaves the site unless it is an essential service that she needs.
P7	Prefers email or paper-based reading. Prefers laptop over reading on a mobile.
P10	Show a star rating for the privacy policies that is ideally obtained through user reviews or a government rating committee.

Table 11 - Question 5 from the Navigation Section

Is there anything else you think could be done to make the navigation of privacy policies more user-friendly and intuitive?	
P2	Clicking on hyperlinks is much better than scrolling.
P3	Links will be helpful.
P4	Table of contents will be helpful but they would still prefer to talk to someone regarding questions rather than reading. It is difficult to find someone to talk to, even if she gets through to someone there is often an issue with understanding accents.
P8	Should be easy to locate and learn how to opt-out. There is a triangle used in targeted advertisements that a user can click. This goes to the advertisement policy, click on not interested but this still appears, and the opting out doesn't work, with such experiences the customers lose trust and think trying to get control of what they see and what they share is a waste of time because it never works.

Table 12 - Question 6 from the Navigation Section

How much time are you willing to spend navigating a privacy policy to find the information you need?	
P1	Less than 5 minutes
P2	There should be no rules to click on everything to sign a document. If the customer wants or needs to use the service, they are going to sign it.
P4	A section called 'Quick Start' would be super helpful. Would read this.
P5	No time unless it is an essential service.
P6	5 minutes at the most.
P7	As long as it takes. Considers herself a fast reader, if she is signing something she will make it a point to read it. *(MV: I don't believe this)*
P8	Less than 5 minutes, they will just go through the index of the document.
P9	5 to 10 minutes maximum. Took a speed-reading class at Harvard that taught her how to glance through documents to look over important content fast. Suggests a 24-hour cancellation policy to be implemented where if a consumer accepts and signs a privacy policy in. hurry because they need to use the service now (like Bluebikes, Uber, Lyft, etc.) and later realize they do not agree, they can retract their acceptance.
P10	Has to be short, there needs to be some standardization.

Table 13 - Question 7 from the Navigation Section

Do you prefer a menu-based navigation system, or do you prefer to navigate through a privacy policy by scrolling?	
P1	Does not prefer a menu-based navigation.
P2	Prefers Link based navigation.
P3	Prefers table of contents.
P7	Prefers a menu.

P8	Prefers a menu based navigation with links.

Table 14 - Question 8 from the Navigation Section

Do you find it helpful when a privacy policy has a table of contents or index to help you navigate the content?	
P1	Yes, it is helpful.
P2	The not so obvious information should be shown first.
P3	An Index will be helpful.
P4	Index or table of contents – to enable customers to go to and see only what they want to see.
P7	Menu at the beginning, Index at the end.
P8	Index will help.
P9	Organizing the information at the top would be great.
P10	Table of contents.

Table 15 - Question 1 from the Readability Section

Do you find privacy policies easy to read and understand? If not, what parts are difficult for you to understand?	
P1	Legal terms are difficult to understand. Difficult to understand what will happen if there is a problem that arises.
P2	Would end up agreeing to everything as doesn't want to lose access to some services if there was an opt-out model. Feels like FOMO (Fear of Missing Out) when it comes to features and services).
P3	The legal jargon is difficult.
P7	There might be no need to simplify this as it is meant to be complicated
P8	They are not easy, have been working with lawyers in the financial industry for more than 40 years and believe that lawyers are trained to cover all bases and give detailed information that sounds very technical.

Table 16 - Question 2 from the Readability Section

Do you prefer a privacy policy that is written in a more formal tone or one that is written in a more conversational tone?	
P1	Conversational tone, however it might feel less binding – probably a good thing.
P2	Conversational tone, prefers to call the company and talk to someone. Phone number from the website to call is needed.
P3	Conversational tone.
P4	Conversational tone.
P5	Conversational tone.

P6	Conversational tone, voice and sound based ideally (should not be a monotonous tone).
P7	Doesn't matter much, expects some formal tone. Said that it is not a letter to a friend to have a conversational tone.
P8	Conversational tone, this would not dilute the seriousness of the information. Examples of the Security and Exchange Commission (SEC). They simplify the language used in investment documents. There is a requirement of a summary prospectus and the use of friendly and understandable everyday language.
P9	Conversational tone. Most companies hide behind legal language, and only trained lawyers can make sense of this information. It is important for consumers to understand this data and hence a conversational tone will help this.
P10	Conversational tone. Informality creep into use is seen today in medical procedures and their consent forms. (Example: There could be a risk of bleeding, but the doctors will try their best to stop if it occurs and also ensure that they have the support to handle this. The doctor sounds confident while saying this which makes the patient comfortable.) How can technology companies make people comfortable in a similar way?

Table 17 - Question 3 from Readability Section

Would you prefer a privacy policy that uses examples or scenarios to help explain how data is collected and used?	
P1	Explanation through scenarios might be very helpful.
P2	Scenarios and Examples will be helpful. The current language is 'could use' and this can be confusing. Will the company collecting consent use my information or not? Language is very ambiguous.
P3	Scenarios and examples might help those who are not educated or are less privileged as it will be easier for them to understand. If the scenarios are more like comics, the seriousness of the data might reduce.
P4	Scenarios along with more pictures will help.
P5	Scenarios with FAQs will be the best way. (Examples: …. scenario 4 – go to paragraph 4 (2b) and turn it off)
P6	Scenarios
P7	Examples would be helpful.
P8	Examples and scenarios will help. Relatable examples help in understanding.
P9	Scenarios will help. Sharing the information with examples in the format of pie-charts will be nice. Referred to the stock's prediction analogy. Crowdsourcing this data with examples of *'How many people opted-out of this?'*
P10	Scenarios and examples will help. Common things that can go wrong and FAQs will help too. If something happens, what does the consumer do? How will scenarios be handled?

Table 18 - Question 4 from Readability Section

How important is it to you to know what data is being collected and how it is being used?	
P2	More important to know WHY they are collecting the data they are collecting. For example, iRobot collects the house layouts and in case of a data breach a hacker could have access to a customer's house layout. They collect the location data too so the customer could be at a risk of being robbed.

P3	Extremely important, don't use Alexa or any voice assistant because of the fear of voice retention and the ambiguity about whether the recordings are stored or not.
P6	They wonder if we really need to worry about this. However, had some previous experiences where some application she was going to use asked her to grant access to the phone's *Contact List* and hence decided not to use the service. She wonders why they would need access to her personal contacts and thought maybe giving reasons about why they would use this data would be one step better than just making a blanket access statement. There could also be checkboxes that allow customers to opt-out of certain data sharing, possibly to get a lesser number of features.
P7	On a scale of 1-10, she said 9.

Table 19 - Question 5 from Readability Section

Would you prefer a privacy policy that is shorter and more concise, or one that provides more detailed information?	
P1	Executive Summary, like a research paper has one at the beginning, could be like the abstract section too.
P2	Should be like a voting experience, if a customer selects yes – examples of what could happen, and if a customer selects no – examples of what could happen.
P3	A summary would be helpful. There should be a short and a long version of such documents. More concise is better, less is more.
P4	Prefers having the ability to have a conversation with somebody to understand what is important and needs attention.
P7	Should be detailed.
P8	Summary.

Table 20 - Question 6 from Readability Section

Is there anything else you think could be done to make privacy policies more readable and user-friendly?	
P1	Explanation through scenarios might be very helpful.
P2	Would prefer to opt-in instead of opting-out. Going to the application on the mobile to make these changes is fine.
P5	Older adults have aging eyes, and also prefer to read newspapers online because it is possible to read them in bigger font size. "Here's three things that you might want to know" should be clear and concise – all the relevant information should be highlighted.
P10	Brevity, standardization. Flip-the-model approach – default settings ensure maximum privacy; consumers have to opt-in beyond this. If the privacy ratings generated by the Government privacy committee are publicly available, companies will be under pressure to ensure they provide good support regarding privacy related issues.

Table 21 - Question 1 from Presentation Section

How important is it to you to have a privacy policy that is presented prominently on a website or app?	
P1	Doesn't want to download a trillion applications on the phone. If something needs an app download, customers will ignore it unless they need and know they will use it every day.
P6	Website
P8	Integrated within the application.
P9	Currently most are in the apps, but a lot of people who might be in a hurry don't have a battery are not able to devote time on the phone as they are on the go. Emailing the link to the website will be the best option so people have it if they want to read it later.
P10	Concise. Something as simple as three packages (like a credit card model) can be a platinum/ Silver/ Gold package based on user preferences and types. Questions can be asked around, *"What kind of user are you?" (Basic/ Advanced)* and based on that companies can pre-filled an opted-in/ opted-out list of settings to save time.

Table 22 - Question 2 from Presentation Section

Would you prefer a privacy policy to be presented as a pop-up or as a separate page on a website or app?	
P1	Should be a combination. For ease of use it could be a pop-up and there can be a link to click for getting more information which leads to either a PDF or a website.
P2	If there are links that say 'Click here' for more information about a particular section, the details can be included in a pop-up, the probability of reading is high. If everything is shown all at once, I probably will not read anything.
P4	Separate window.
P6	A different page/ separate window will be better. Pop-up seems like it might be a warning message.
P7	Pop-ups will be fine if they are not jarring and annoying.
P9	Most people disable pop-ups because they are very annoying and distracting, prefer a separate page – or email, and mostly manage everything via emails.
P10	Pop-up wouldn't be read by most users. Most have already made the decision to engage so they will just go ahead and accept it.

Appendix D

Figure 7 - Mini summaries of some participants

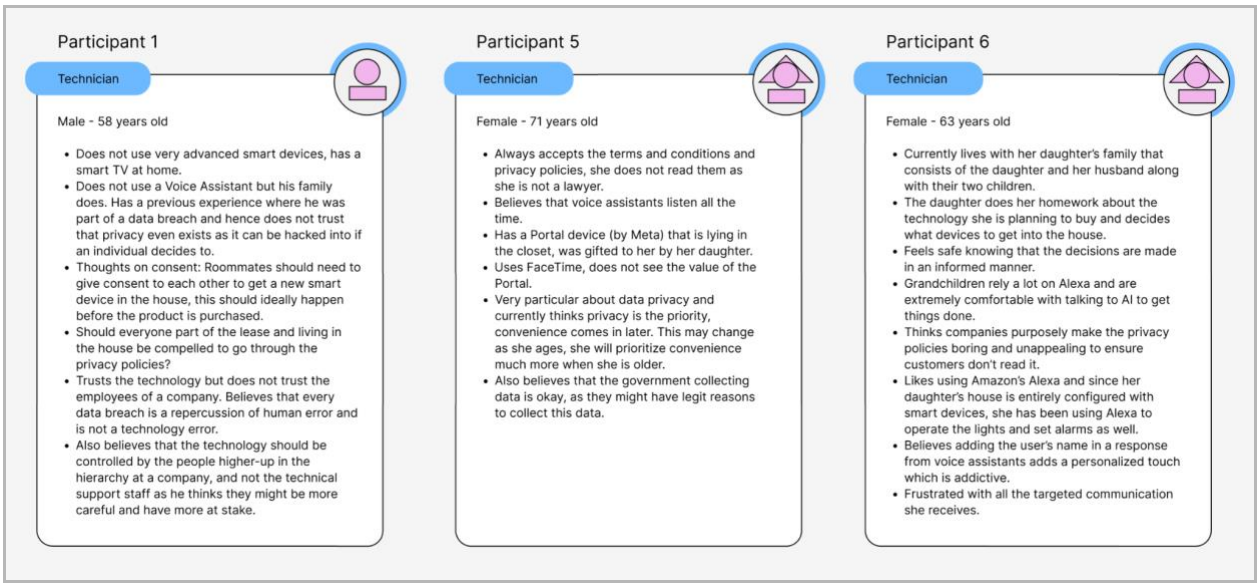
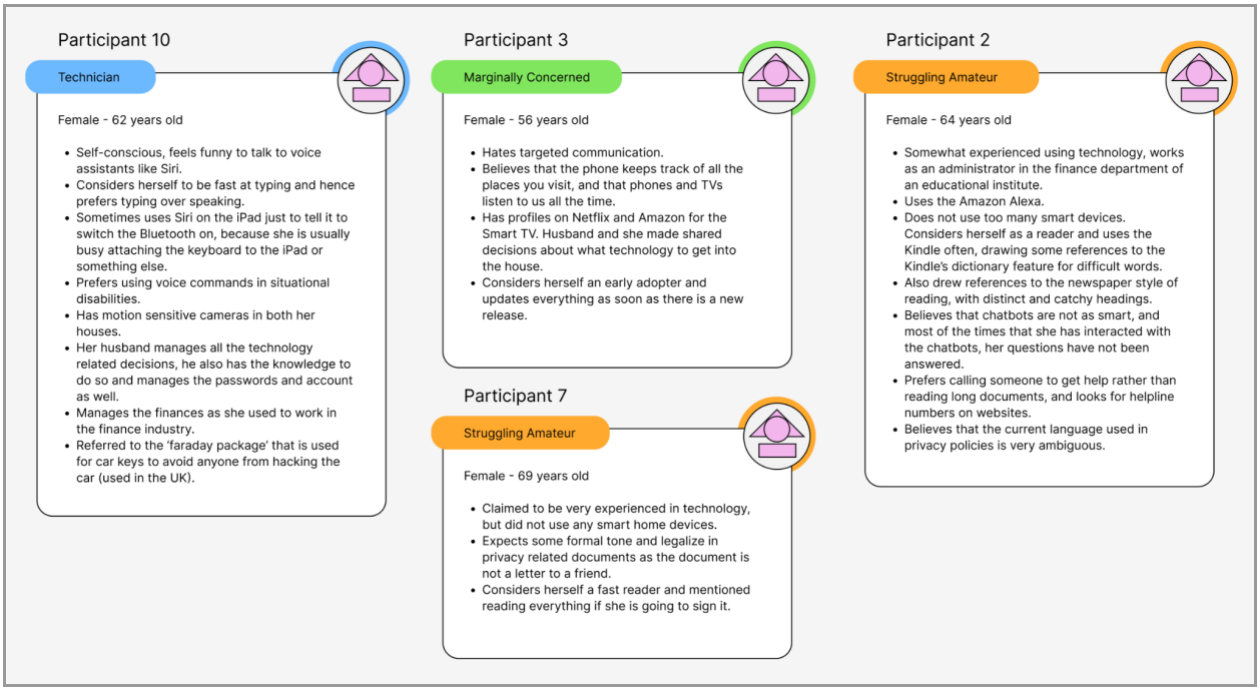


Figure 8 - Mini summaries of some participants



Appendix E

The following are the various prototypes used during the user testing in Chapter 5.

Figure 9 - Prototype for 5.3.2.1(c) - Option 3

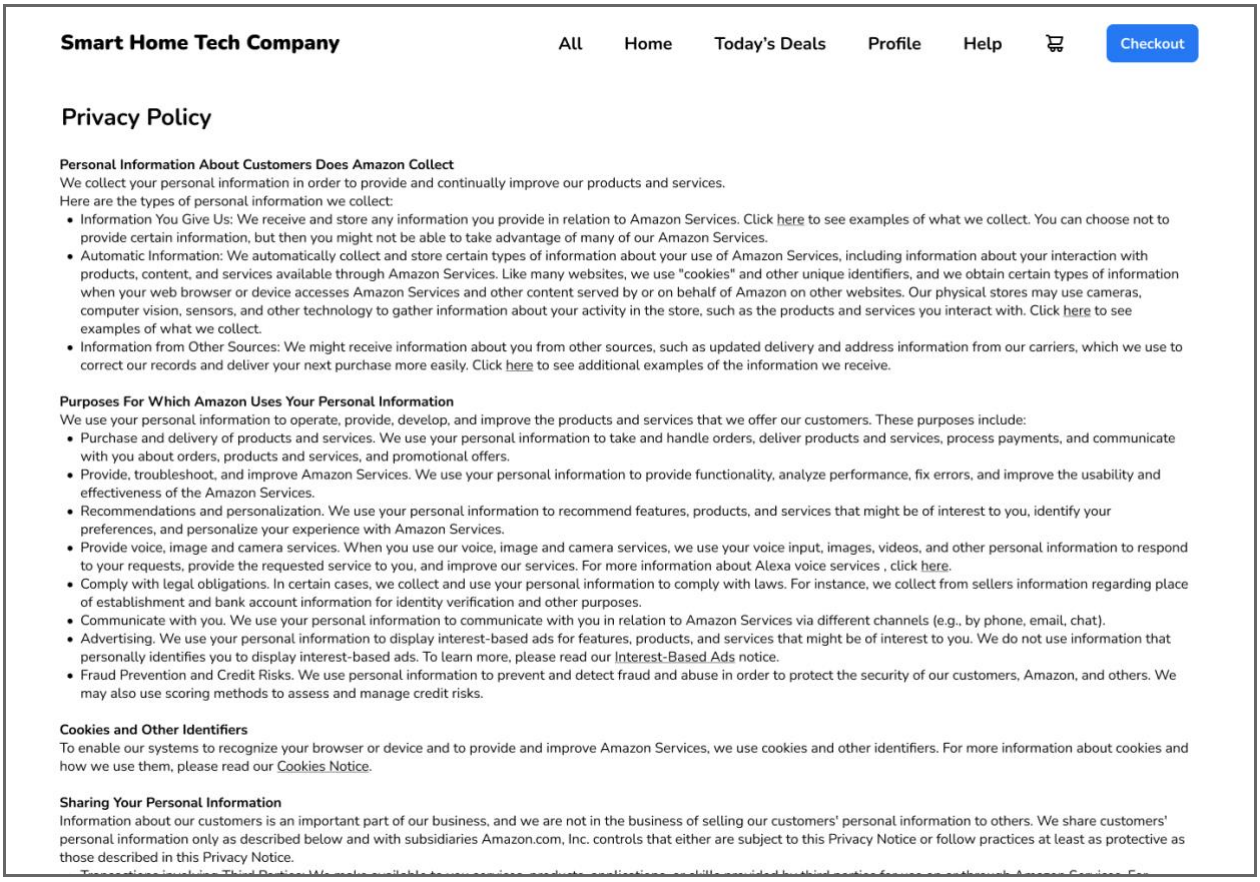


Figure 10 - Prototype for 5.3.2.1(d) - Option 4

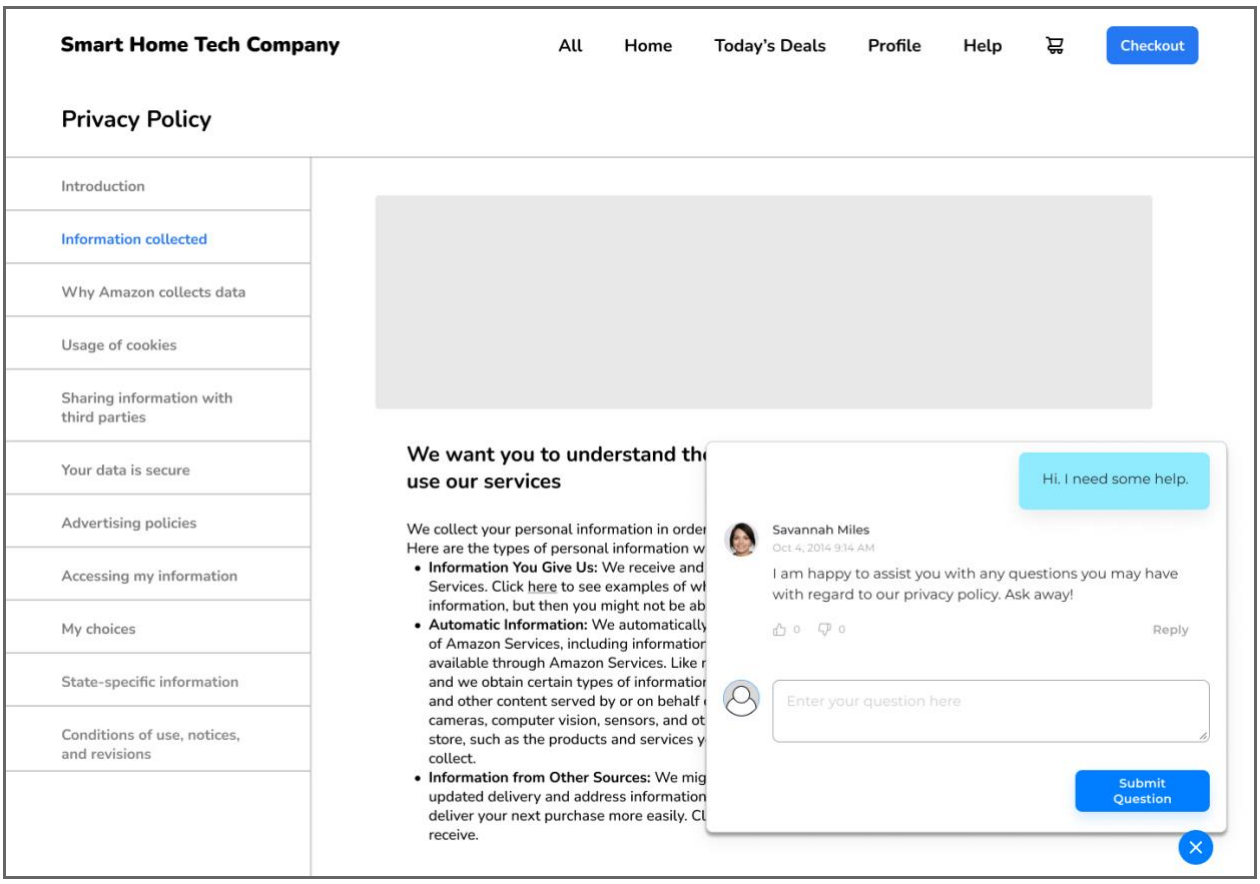


Figure 11 - Prototype for 5.3.2.2(a) - Option A

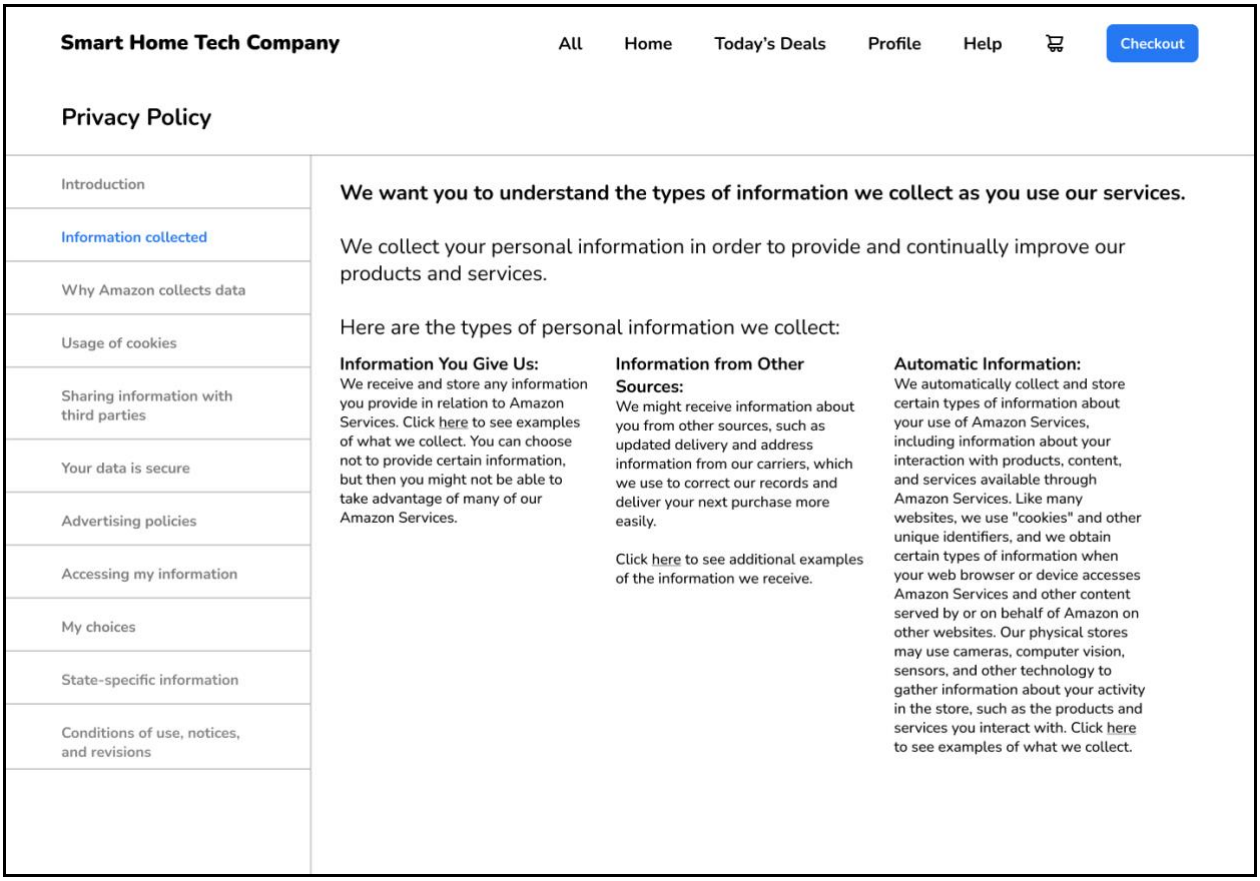


Figure 12 - Prototype for 5.3.2.2(b) - Option B

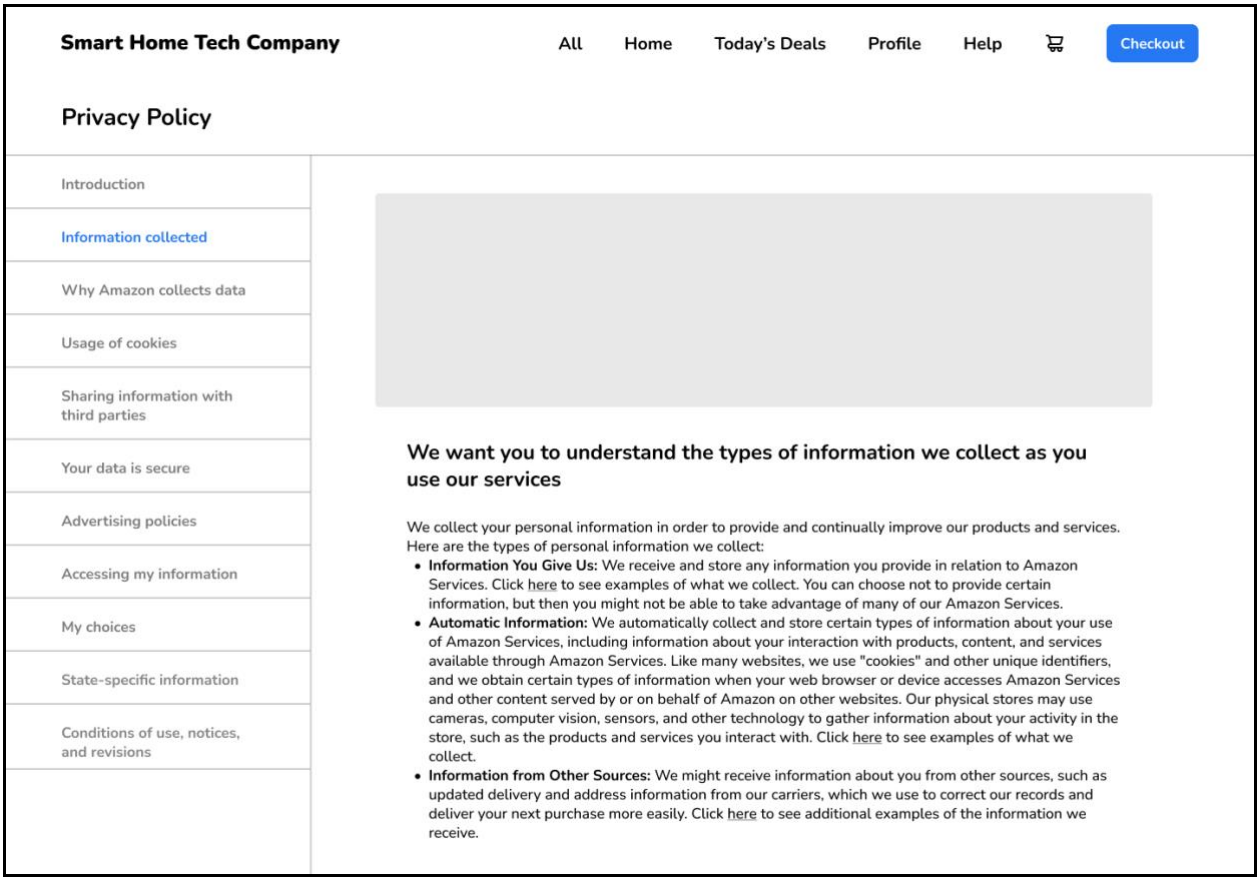


Figure 13 - Prototype for 5.3.2.3(a) - Option A

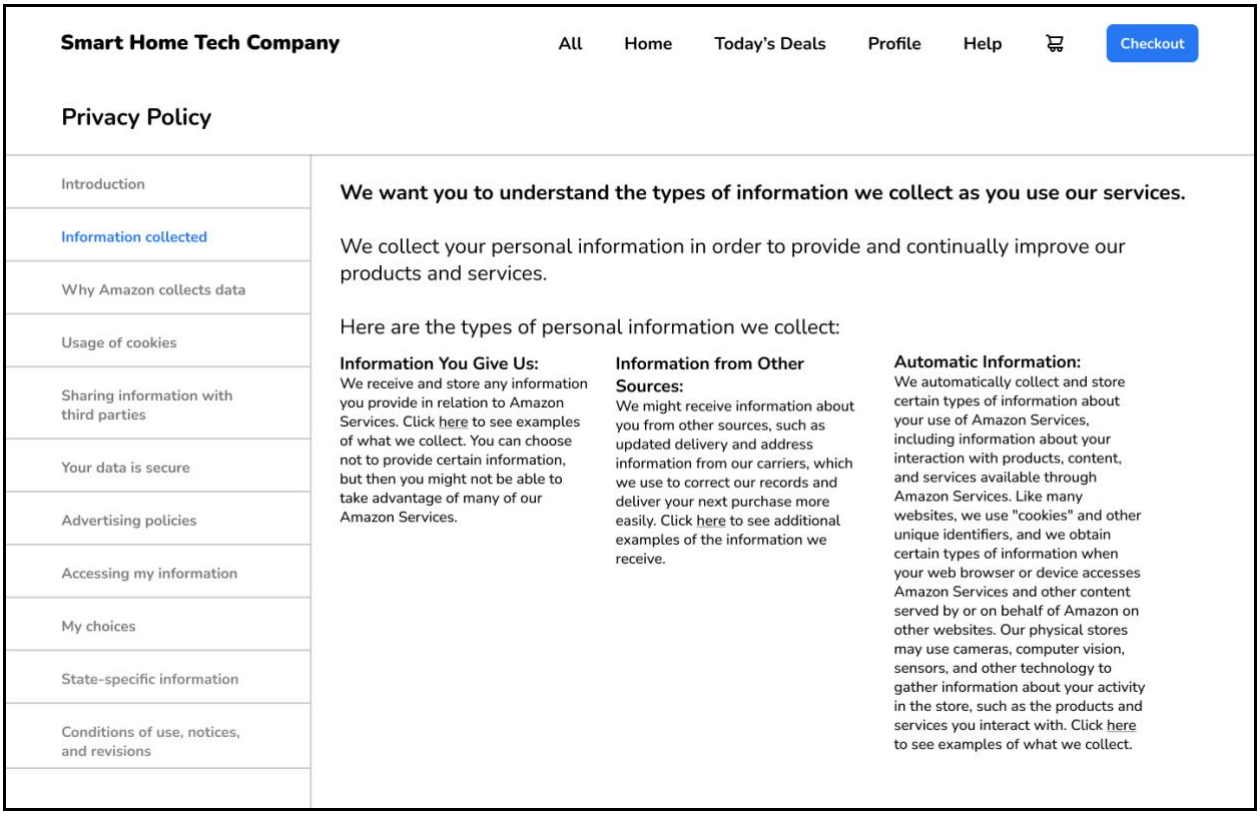


Figure 14 - Prototype for 5.3.2.3(b) - Option B

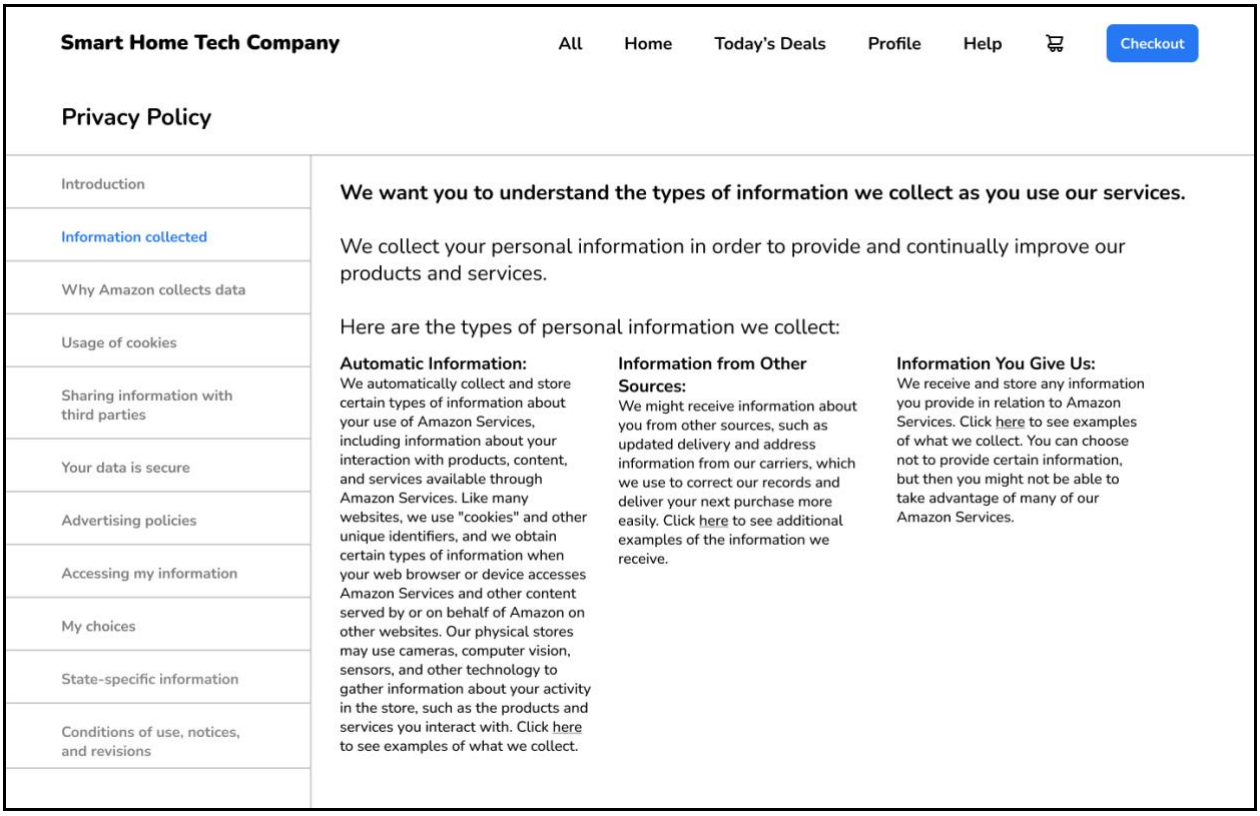


Figure 15 - Prototype for 5.3.2.4(c) - Option C

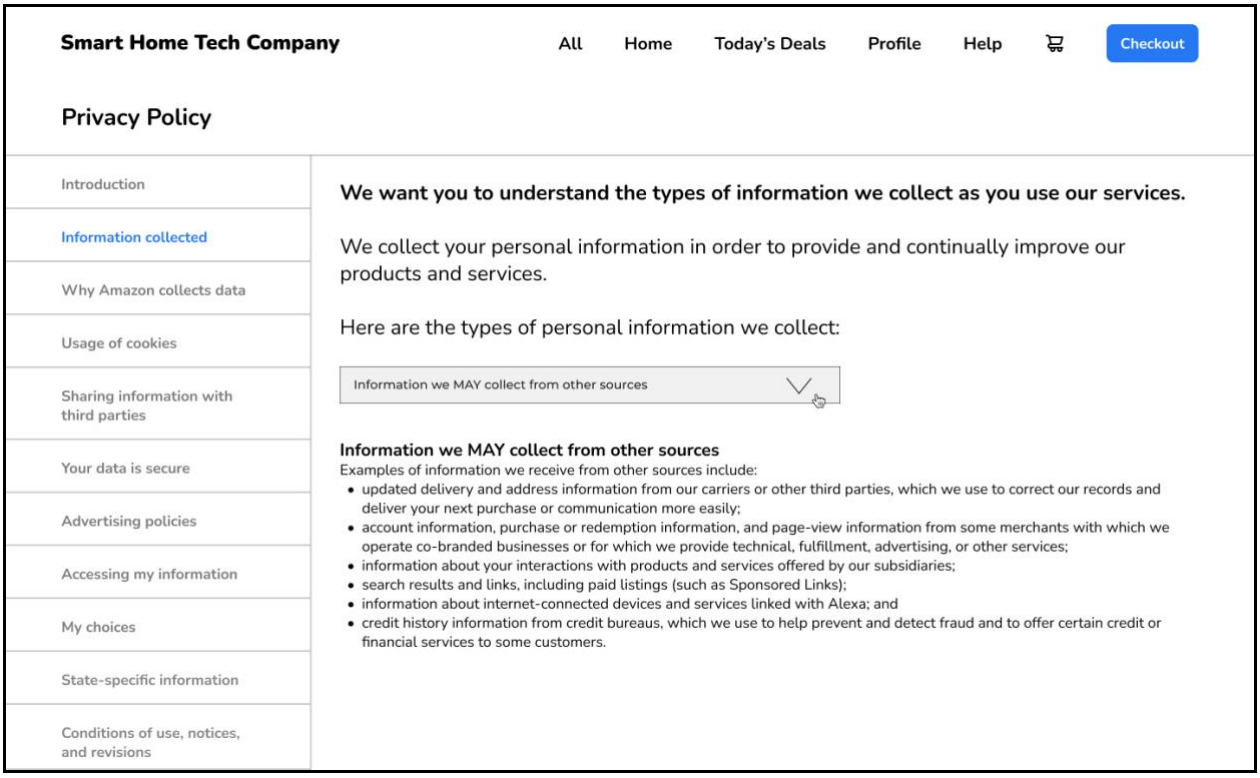


Figure 16 - Prototype for 5.3.2.5(a) - Option A

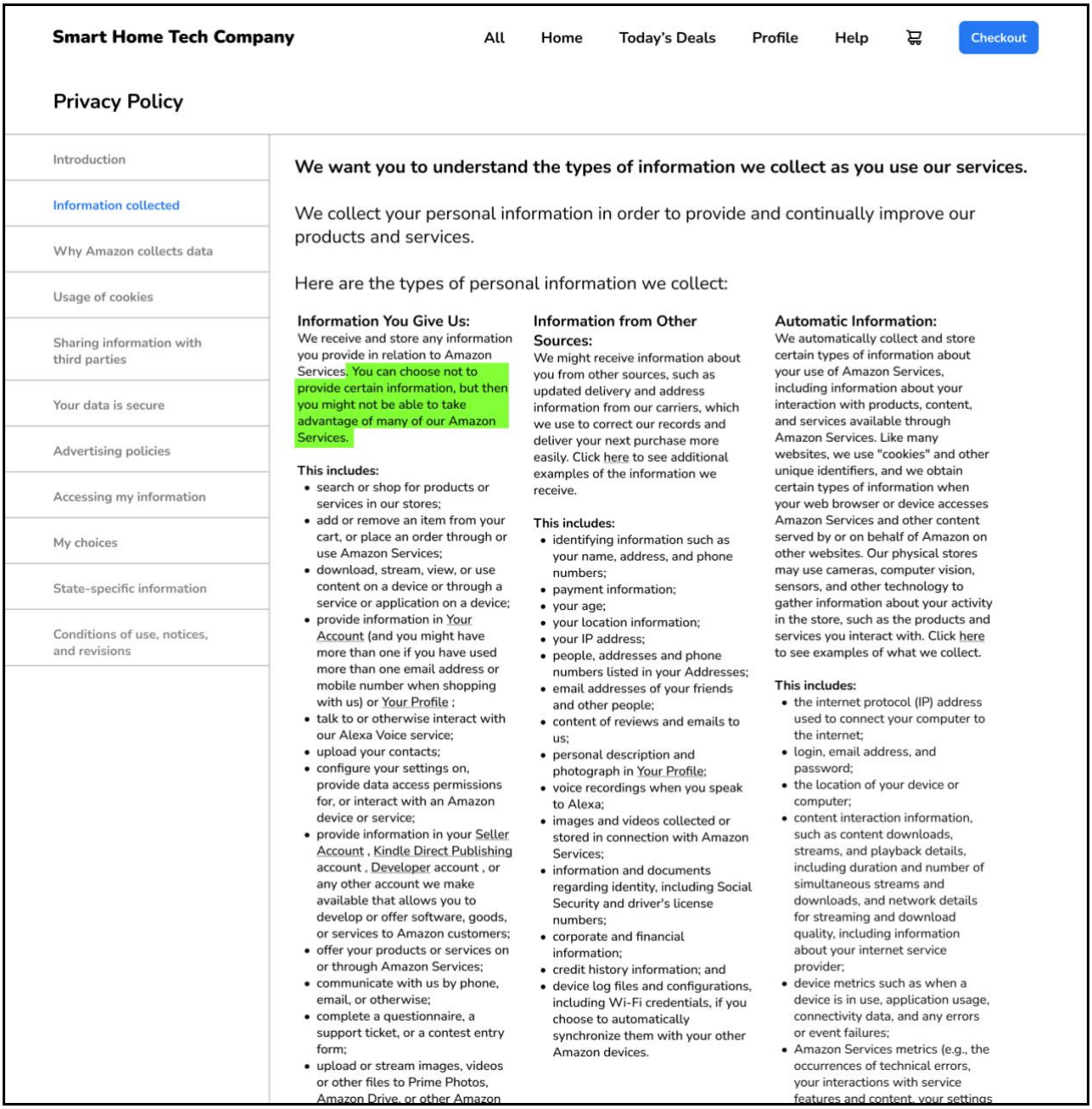
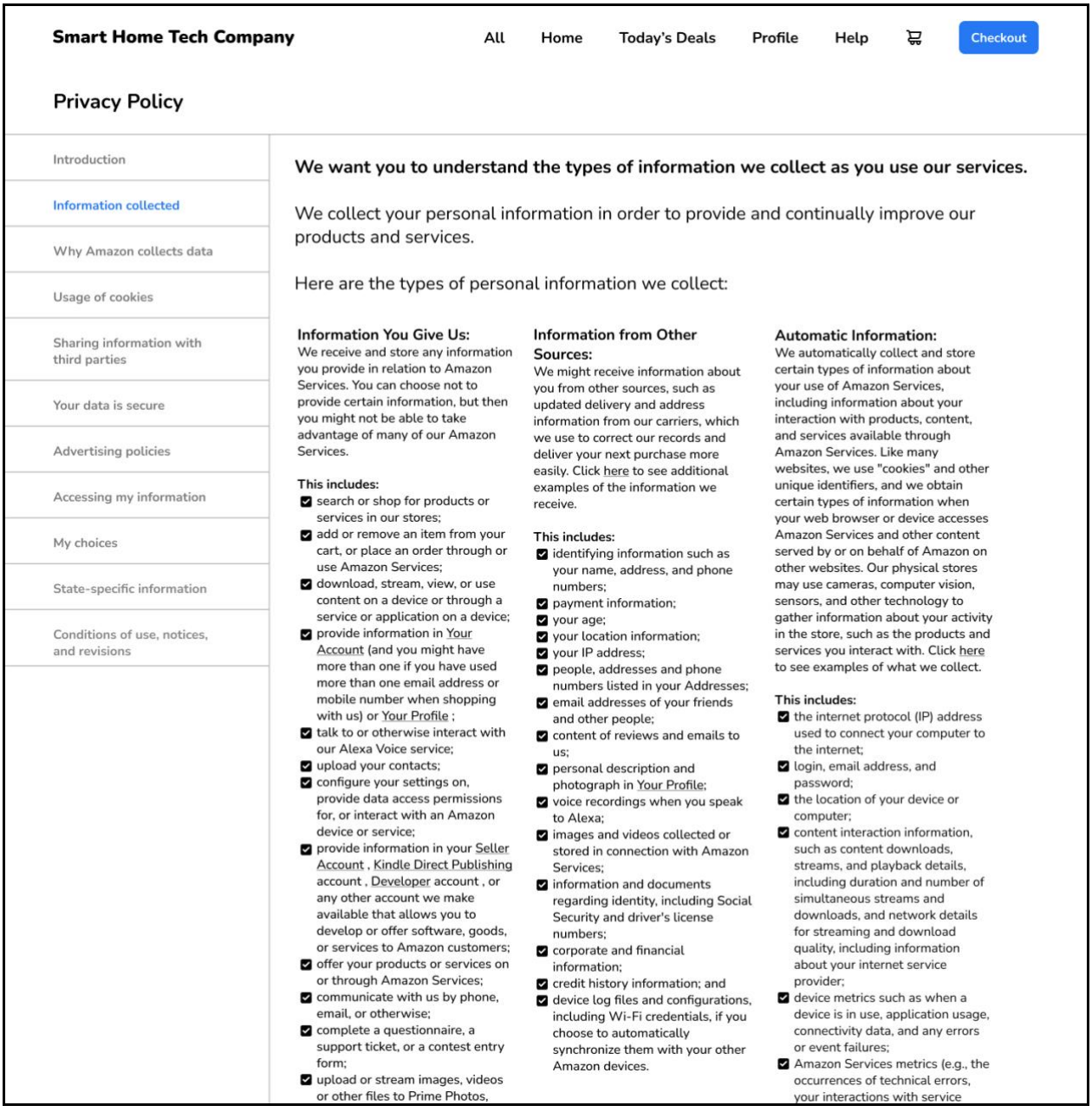


Figure 17 - Prototype for 5.3.2.5(b) - Option B



Appendix F

Some of the user experience design principles that are relevant and could be applied to privacy policy and user agreements' designs.

1. Miller's Law: Processing Capacity and Chunking Information

A principle called Miller's Law (1956) in cognitive psychology states that the average person can only hold 7 (plus/minus 2) items in their working memory at any given time.[19,20] This means that our capacity to process information is limited as we can only handle a certain amount of information at once. Dividing information into smaller chunks also helps with processing and the way we retain information for referring back to any of it if needed. In the policies reviewed, on average there are 17 key pieces included in a privacy policy that need the user's attention. Please refer to table 5.3.3.1(a) that lists the information in detail.

Table 5.3.3.1(a)

Key Information in Privacy Policies
1. Identifying the site or app owner
2. Effective date of the policy
3. Customer data collected
4. How the data is used to improve products and services
5. How different data collected for improving customer experience through behavioral practices is used for refining marketing strategy
6. How personal data is secured by learning to capture and recognize specific users' input
7. Data analysis
8. Data storage and protection practices
9. Compliance with the GDPR
10. Compliance with the CCPA
11. Compliance with other state laws
12. Tracking tools used
13. Third-party access
14. Cookies statement
15. Accessing and making changes to the default settings

[19] Laws of UX. (n.d.). Miller's Law. Retrieved April 16, 2023, from https://lawsofux.com/millers-law/

[20] Khan Academy. (n.d.). Miller's law, chunking, and the capacity of working memory. Retrieved April 16, 2023, from https://www.khanacademy.org/test-prep/mcat/social-sciences-practice/social-science-practice-tut/e/miller-s-law--chunking--and-the-capacity-of-working-memory

16. Opt-out clause
17. Description of process for changes and updates to the policy

Potential alternatives or solutions to deal with the amount of information could be to present the 7 most important points or to group information into 7 +/- 2 meaningful chunks in the form of a summary. Framing the top most important points as FAQs that are presented at the top of the policy should also allow users to process the information and retain it in their memory for further reference more readily.

2. Jakob's Law: Leveraging Existing Mental Models and Benefits of Standardization

Jakob's Law is a principle in user experience design that states that users expect a website or app to work the way other websites or apps work. In other words, users bring their past experiences with similar products or interfaces to their current experience, and they expect the same patterns and conventions to apply. In today's internet age, we interact with websites and various digital interfaces all the time.[21] If we leverage existing mental models that users have, we can encourage people to focus on the information instead of learning new ways to navigate the document. For example, standardization of privacy policies would be an important step toward reducing the cognitive load of having to read every policy.

3. Doherty Threshold: Designing for the 'Golden 60 Seconds'

A concise executive summary, similar to the one in research papers, would be helpful to explain what needs attention in an entire policy. Some ideas around a 'consequential design' came up, such as if a user opts in or opts out of a particular data sharing aspect, this kind of design would highlight the consequence of it and should tell the user what they gain or lose access to if they select this option. This suggestion highlighted the effectiveness of the Doherty Threshold in privacy policies and user agreements. The Doherty Threshold[22] is also known as the 'Magic Moment' or the 'Golden 60 Seconds,' which implies that a user makes their decision regarding whether to use a product or not in the first 60 seconds of their interaction with the interface. When it comes to privacy policies, most users abandon attempting to read the document within the first 60 seconds, scroll right to the bottom, and sign it or accept the terms and conditions by checking the box to proceed using the product or service. Adding a summary at the top with the important content that a user can potentially read in 60 seconds with hyperlinks to different sections that are relevant could possibly help in overcoming this issue.

4. Picture Superiority Effect: Pictures Trump Text

The Picture Superiority Effect suggests that users tend to remember visual information such as pictures or images or other information presented in a visual format better than plain written text. Adding visual elements to privacy policies to convey information easily can help with a better understanding of the content. Privacy policies are presented in written media. Products that were referred to by participants to move away from the written medium could potentially be incorporated into privacy policies to encourage users to understand implications and make informed decisions.

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[21] Laws of UX. (n.d.). Jakob's Law. Retrieved April 16, 2023, from https://lawsofux.com/jakobs-law/

[22] Doherty, G. (1997). A practical guide to usability testing. Intellect Books. Chapter 6, "How Fast Is Fast Enough?"

5. Occam's Razor: The Power of Simple Explanations

The principle of 'Occam's Razor' (William of Ockham, ca. 1320/2004) suggests that the best explanation anything can have is usually the one that is the simplest.[23,24] In privacy policies and user agreements, Occam's Razor emphasizes the importance of minimalism and simplicity and the ease for content to be understood for better comprehension.

[23] Maeda, J. (2006). The laws of simplicity. MIT Press.

[24] Krug, S. (2014). Don't make me think: A common sense approach to web usability. New Riders.