

Let's *talk* about privacy

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Abstract

While many studies have shown that the notice and choice paradigm constitutes a significant burden and challenge for users, and while research has been done to explore best practices to make this situation a bit better, the overall status quo is still quite poor. This problem will only grow as more devices become internet-connected and as these devices become more diverse in functionality and interaction type. In this thesis, I will offer evidence that our current GUI-focused paradigms for notice and choice research are not keeping up with emerging technologies, propose additional ways of thinking about privacy choices, and test some approaches that could be more fitting, particularly in the context of conversational interfaces.

I will first describe a body of collaborative work from the past few years in which I have explored how current privacy interfaces and tools do and do not meet users' needs. This will include discussing recent work on websites' opt-out and data deletion choices as well as advertising controls on Facebook.

Next, I will describe a three-phase case study in which I iteratively redesigned and evaluated the consent flow for a chatbot being developed for a large U.S. health insurance company's online platform. Ultimately, simplifying the interface and language of the consent flow did help to improve the overall user experience and usability, and users did understand important points better with the redesigned versions *if* they were instructed to revisit them a second time. However, the redesigns made little to no detectable difference in what users understood when going through the flow in a natural way with another non-privacy task as the main focus, supporting the idea that the overall paradigm of presenting users with legal documents unrelated to their primary tasks is fundamentally dysfunctional.

The penultimate chapter will focus on a study in which I am comparing standard privacy policy disclosures to a more conversational approach in the context of signup and onboarding for a social media app. I created five interactive prototypes that vary in terms of (1) how much privacy information is presented on the main screen and (2) whether they present additional privacy information primarily via a standard data policy link or via an approach where participants can choose from a set of likely questions in a more conversational style. To test these, I am applying the evaluation framework proposed in Hana Habib's doctoral thesis [7], focusing on user needs, ability and effort, awareness, comprehension, and sentiment.

In the final portion of my thesis, I plan to build and test a voice user interface prototype that offers voice-based privacy interactions rather than the decoupled interactions that platforms like Alexa currently tend to offer. I will explore and report on any conflicts between best practices for privacy notice and choice and best practices for voice interface design that I encounter. I will then gather qualitative and quantitative data to compare this prototype to existing decoupled approaches, evaluating based on Habib's framework.

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Chapter 1

Introduction

Ultimately, while a number of studies have demonstrated that understanding privacy disclosures and making privacy choices are significant burdens for users, and while research has been done to explore best practices to make this situation a bit better, the overall status quo is still quite poor. Privacy notices are notoriously long and time consuming to read [13], and they tend to be written in language that serves to ease the minds of company lawyers rather than helping the average user to understand the choices available to them [6, 12], but others have shown little effect from simplifying such disclosures [1]. In addition to spending hundreds of hours per year reading legal documents to understand what they were agreeing to when signing up for and using services, to make choices such as opting out of data collection, a user often must spend a great deal of time and effort finding privacy options buried in difficult-to-discover menus. [todo]citations

The problems with the existing notice and choice paradigm will only be worsened with the increasing prevalence of emerging technologies that use types of interfaces that lend themselves poorly to presenting users with a long document to read on a screen. Our status quo wherein users are expected to visually read privacy disclosures and then make privacy choices using a GUI does not fit neatly with emerging technologies such as voice assistants or extended reality platforms.

In this thesis, I will offer evidence that our current GUI-focused paradigms for notice and choice research are not keeping up with emerging technologies, propose additional ways of thinking about privacy choices, and test some approaches that could be more fitting, particularly in the context of conversational interfaces.

I will first describe a body of collaborative work from the past few years in which I have explored how current privacy interfaces and tools do and do not meet users' needs. This will include discussing recent work on websites' opt-out and data deletion choices as well as advertising controls on Facebook.

In the next chapter, I will describe a three-phase case study in which I iteratively redesigned and evaluated the consent flow for a chatbot being developed for a large U.S. health insurance company's online platform. In this study, I first conducted a remote usability study to obtain qualitative data about usability and user understanding, and I used those findings as well as best practices to improve the design of the consent flow. I then compared the original version to redesigned versions in two online surveys. Ultimately, simplifying the interface and language

of the consent flow did help to improve the overall user experience and usability, and users did understand important points better with the redesigned versions *if* they were instructed to revisit them a second time. However, the redesigns made little to no detectable difference in what users understood when going through the flow in a natural way with another non-privacy task as the main focus, supporting the idea that the overall paradigm of presenting users with legal documents unrelated to their primary tasks is fundamentally dysfunctional.

The penultimate chapter will focus on a study that is in progress in spring 2022 in which I am comparing standard privacy policy disclosures to a more conversational approach, partially inspired by video games, in the context of signup and onboarding for a social media app. I created five interactive prototypes that vary in terms of (1) how much privacy information is presented on the main screen and (2) whether they present additional privacy information primarily via a standard data policy link or via an approach where participants can choose from a set of likely questions in a more conversational style. To test these, I am applying the evaluation framework proposed in Hana Habib’s doctoral thesis [7], focusing on user needs, ability and effort, awareness, comprehension, and sentiment. I am currently conducting a remote user study with a task and semi-structured interview to obtain qualitative data about these prototypes, and I will later conduct an online survey via Prolific to gather quantitative data to compare the prototype versions and examine whether the more conversational versions of the prototype confer any advantages.

In the final portion of my thesis, I plan to build and test a voice user interface prototype that offers voice-based privacy interactions rather than the decoupled interactions that platforms like Alexa currently tend to offer to users who ask voice assistants about their privacy practices or options. I intend for this prototype to incorporate best practices for privacy notice and choice and for voice interface design. I will explore and report on any conflicts between best practices for privacy notice and choice and best practices for voice interface design that I encounter. I will then gather qualitative and quantitative data to compare this prototype to existing decoupled approaches. First, to iterate on a design to test, I will gather qualitative data about how users naturally discuss privacy in real-world conversations, as well as data about users’ perceptions of and interactions with preliminary versions of the prototype. I will then compare the performance of a final prototype to an existing decoupled approach in a quantitative study and compare it to the current status quo for voice interface privacy interactions on metrics related to user needs, effort, awareness, comprehension, and sentiment.

Thesis statement

This thesis will highlight problems with current privacy notice and choice practices and demonstrate when and how conversational approaches to notice and choice may improve the experience for users (understanding of what they have consented to, satisfaction with their choices, and trust in the system).

Chapter 2

Background and related work

2.1 Notice and choice 1.0: The wall of text

Historically, we have relied on privacy policies and the like to provide technology users with a semblance of informed choice. We know, however, that someone who read all of the privacy notices for all of the products and services that they used could be expected to spend hundreds of hours per year on this task [13]. Unsurprisingly, less than a quarter of U.S. adults surveyed by Pew Research in 2019 reported that they always or often read privacy policies, and 36% reported *never* reading them [?].

One reason for this is certainly the length and complexity of these documents, and numerous researchers have explored methods of shortening and simplifying disclosures to help users efficiently grasp the most important details. Studies have suggested that approaches such as short-form policies and “privacy nutrition labels” can help users find and understand privacy information [6, 12]. In addition, a study on End User License Agreements (EULAs) found that users spent more time reviewing paraphrased EULAs than traditional long-form EULAs, and that paraphrased EULAs yielded more positive sentiments and higher comprehension [?]. However, in a study by Ben-Shahar and Chilton, policy simplifications had little to no effect on users’ understanding or their consent choices. The authors of that study speculate that users may be entirely “numb” and “unmotivated to use privacy notices of any kind” [1]. [todo]elaborate

2.2 Notice and choice 2.0: Better “best” practices

Researchers have established some best practices that might improve users’ chances of actually understanding privacy disclosures and making informed decisions that match their intentions and values. In 2015, Schaub et al. reviewed the literature on privacy notice design and made a number of recommendations...[todo]more here

In the first study described in my thesis, I applied many of these best practices to the HIPAA authorization for a healthcare chatbot, including identifying and providing control over practices that might be unexpected, avoiding jargon, conducting user testing, and trying not to overwhelm users with multiple choices.

[todo]add more about current best practices

2.3 Notice and choice 3.0?: Conversational privacy as a potential tool for emerging technology contexts

[todo]better define what this is There is a growing interest in the topic of “conversational privacy” as an alternative to traditional notice and choice paradigms, which are known to have low usability. Conversational privacy could end up being especially beneficial in the context of conversational user interfaces (CUIs), since it could offer notice and choice mechanisms native to the interface in question. As of 2022, common voice assistant platforms such as Alexa, Siri, and Google Home have very little capability to answer privacy queries within the voice interface [2, 14]: in many cases they don’t understand or offer coherent responses to these queries at all, and when they do understand, they often shunt users to mobile apps or websites to read privacy information. Researchers have suggested that adding conversational privacy functionality could potentially mitigate user mistrust about the data practices of CUIs [3].

Researchers have begun to build early-stage prototypes of conversational agents that could handle privacy queries. In 2016, Harkous et al. proposed PriBot, a conversational agent that could engage with users to help them understand privacy policies and other disclosures [11]. In 2022, Bruggemeier et al. published (possibly the first) user study evidence of the effectiveness of conversational privacy prompts. They found that such prompts may positively impact users’ perceptions of a system’s security and privacy (compared to a CUI that does not prompt users about available privacy choices), and that users may be interested in making privacy choices using conversational mechanisms [3]. However, as of January 2022, no studies (to my knowledge) have compared conversational privacy approaches to more traditional notice and choice paradigms.

2.4 Voice interface design: research methodology and design best practices

[todo]a bunch of stuff to add here from the past couple years of CUI proceedings

- **[todo]tailoring conversations to recipient’s knowledge:** <https://dl.acm.org/doi/10.1145/3469595.3469625>
- **[todo]discourse analysis approaches:** <https://dl.acm.org/doi/10.1145/3469595.3469622>

2.5 **[todo]potential additional sections/topics might include: dark patterns, regulatory and policy considerations**

Chapter 3

Previous work

3.1 Past privacy choice research

Prior to the independent research that I describe later in this document, I worked on multiple collaborative projects related to privacy choices that have informed and shaped my ongoing and future work [4, 8, 9, 10]:

1. Identifying user needs for advertising controls on Facebook. Hana Habib, Sarah Pearman, Ellie Young, Ishika Saxena, Robert Zhang, and Lorrie Faith Cranor. In *Proceedings of the ACM on Human-Computer Interaction*, Vol. 6, Issue CSCW1. 2022.
2. “It’s a scavenger hunt”: Usability of websites’ opt-out and data deletion choices. Hana Habib, Sarah Pearman, Jiamin Wang, Yixin Zou, Alessandro Acquisti, Lorrie Faith Cranor, Norman Sadeh, and Florian Schaub. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. Conference canceled due to COVID-19. 2020. Video presentation recorded by Sarah Pearman.
3. Informing the design of a personalized privacy assistant for the internet of things. Jessica Colnago, Yuanyuan Feng, Tharangini Palanivel, Sarah Pearman, Megan Ung, Alessandro Acquisti, Lorrie Faith Cranor, and Norman Sadeh. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. 2020.
4. Away from prying eyes: Analyzing usage and understanding of private browsing. Hana Habib, Jessica Colnago, Vidya Gopalakrishnan, Sarah Pearman, Jeremy Thomas, Alessandro Acquisti, Nicolas Christin, and Lorrie Faith Cranor. In *Proceedings of the Fourteenth Symposium on Usable Privacy and Security (SOUPS 2018)*. August 12-14, 2018. Baltimore, MD, USA.

3.2 User-friendly yet rarely read: A case study on the re-design of an online HIPAA authorization

In this study, we described the iterative refinement and evaluation of a consent flow for a chatbot being developed by a large U.S. health insurance company [15]. This chatbot used Google

Cloud technology for data storage and natural language processing, and as a result, the company required users to agree to a HIPAA authorization before they could use the chatbot. This was a particularly interesting context to study consent because of the ways in which the chatbot's data practices violated users' expectations (and misunderstandings) of how health data is legally protected in the U.S. In a three-phase interview and survey study, we tested four versions of the consent flow for this chatbot in order to explore whether changes rooted in our empirical observations and recommended best practices could meaningfully improve usability, user understanding, or user sentiment towards the chatbot.

We first conducted three sets of six remote interview sessions in which we observed each set of users interacting with a different prototype consent flow. Prototype 1 was the original version created by HealthCo, Prototype 2 was a version that we simplified and modified to more clearly state data use details, and Prototype 3 was an even further simplified version. Qualitative results from the interviews suggested that Prototypes 2 and 3 could improve on Prototype 1 in usability and understanding.

In the second phase, we analyzed data from 761 participants who had been randomly assigned to use one of the three prototypes tested in the interview study. We asked questions about their experience, their understandings of what they had read, and whether they would be inclined to use such a chatbot if they encountered that consent information in real life. We then displayed the consent information again, asked participants to review it carefully, and asked them again about their understandings of and attitudes toward the chatbot. We found usability benefits to Prototype 3, and users could understand our redesigned prototypes better when asked to review documents carefully, but user understanding was poor across all prototypes on the first pass through the documents.

In the third phase, we surveyed an additional 456 participants to compare users' understandings and opinions of two consent flow prototypes, one of which omitted the word "HIPAA." We also asked questions to further explore what non-experts understood about HIPAA and Protected Health Information (PHI), finding that most respondents grossly overestimated the protections that HIPAA could provide.

Multiple insights from this study may apply more broadly to creating consent flow interfaces and consent documents for tools that handle health data. First, while our refinements did not necessarily improve understanding in the context of a non-privacy-related task, they did seem to improve both overall usability and users' ability to understand the consent documentation if they were prompted to revisit it and read more carefully. While notice and choice best practices and usability studies will not necessarily solve all of the problems inherent to a consent task of this type, we still recommend making changes such as simplifying language, reducing complexity, and drawing special attention to potentially-surprising elements whenever possible.

Second, while the refinements discussed above seem to improve the overall user experience and the *potential* for users to understand consent documentation *if* they read it, we still find that users are unlikely to read and understand these disclosures when they are skimming a document while focused on some other primary task. Importantly, we also find that some of the disclosures we studied are likely to change users' decisions once they understand them. We argue it is important to find ways to highlight main takeaways to users who are unlikely to read every word, and since our refinements were not sufficiently effective in doing this, we argue that researchers and designers should explore more creative approaches to attracting users' attention to disclosures

that may violate their privacy expectations.

A third major insight relates to users' inflated sense of confidence in the privacy and security of healthcare data and their lack of understanding of HIPAA, both of which suggest a need for extreme care in data use disclosures in healthcare contexts.

Our findings help to inform the design of healthcare-related data sharing notices specifically, as well as provide insights on improving the effectiveness of privacy notices in a broader set of contexts.

Chapter 4

Ongoing and future work

4.1 Ongoing work: A conversational approach to mobile app signup and onboarding

4.1.1 Overview

In this study, I will test a more conversational and interactive approach to providing privacy information to users in the context of signup and onboarding for a social media app. The approach I am testing is inspired by non-traditional privacy interfaces encountered in the wild, such as interactions seen in gaming contexts.

4.1.2 Research questions and hypotheses

I will be comparing the following five versions of a prototype across multiple metrics. All versions of the interface will ultimately make the same pieces of privacy information available, but the interactions necessary to acquire that information will vary.

- “Minimal/conversational”: A prototype with a minimal blurb of privacy information on each screen, with a link to a conversational privacy interface for more information
- “Zero/conversational”: A prototype with no privacy information on the screen where the data is requested, with a link to a conversational privacy interface for more information
- “Minimal/policy”: A prototype with a minimal blurb of privacy information on each screen, with a link to Terms of Use and Data Policy at the bottom of each screen
- “Zero/policy”: A prototype with no privacy information on the screen where the data is requested, with a link to Terms of Use and Data Policy at the bottom of each screen
- “Maximal”: A prototype that just offers *all* of the available privacy information about a data point in small text on the screen where it is requested, rather than offering additional links to obtain more privacy information

I will gather qualitative and quantitative data focused on the following items from the framework proposed in Hana Habib’s thesis [7]: user needs, user ability and effort, user awareness, user comprehension, and user sentiment.

My primary hypotheses are focused around the idea that the conversational approaches, particularly the minimal/conversational approach, will yield better user sentiment and understanding when compared to the policy-based approaches. Conversational approaches are also expected to better meet user needs and allow users to find information with lower effort. It is not clear how user awareness will be affected by this less traditional type of interface, so analysis of this point will be primarily exploratory and qualitative. I expect that effects on awareness will be highly dependent on how the conversational privacy interface is introduced (e.g., if the user reaches that user interface using a link, how is that link worded, and do certain wordings help users to understand what that link might lead to?).

4.1.3 Methods

App prototypes

I have constructed five versions of a prototype of a social media signup interface. This interface presents an imaginary social media app called “Frindle” that requests the following information on signup, with each of the following bullet points being requested on a distinct screen:

- First and last name
- Birthday
- Gender/pronouns
- Phone number *or* email
- Password
- Camera and microphone permissions (in the context of recording a video)

Like Facebook, Frindle requires users to give their first and last name and real-life identity. In terms of content, it is presented as being an app more in the style of TikTok, where sharing short videos is a primary focus.

I built these medium-fidelity prototypes in Adobe XD. They are clickable but not fully functional: for example, they do not allow users to actually type information into form fields.

Phase 1: Qualitative

In the spring of 2022, I have been running remote, moderated user study sessions in which users perform tasks using the prototypes. I then ask users semi-structured interview questions about the experience of interacting with the prototype.

Thus far, participants have been recruited using “Gigs” posts posted on Craigslist in the Pittsburgh, PA; Cleveland, OH; and Knoxville, TN regions. Potential participants fill out a screening survey including demographic questions and basic technology usage questions (e.g., type of smartphone used). I am using purposive sampling to maximize the demographic diversity of the participants that are invited to participate. Potential participants selected from the screening data are then invited to fill out a consent form, after which they are directed to a Calendly link to sign up for an interview timeslot.

Users are randomly assigned to one of five conditions to determine which prototype they see. To try to distribute participants with technical expertise evenly across the conditions, I performed

a separate randomization process for the participants who reported having any formal education or work experience in a technical field.

These interviews last from about 45 minutes to an hour. Participants are asked to imagine that they are signing up for a new social media app in real life and to interact with the prototype to proceed through the signup process. I do not say anything to prime participants to think about privacy when this scenario is introduced. We do this in a “think aloud” style where, for each screen, participants are asked to explain the options that they see, describe what they think would happen if they selected those options, and then explain what option they would choose next.

I then ask followup questions related to topics including their sentiments about the overall experience, their understanding of how the different data types that the app asked for might be used and shared, their usual behavior surrounding privacy information and privacy policies, and their needs and preferences.

4.1.4 Progress update and preliminary results

As of the time of my proposal presentation, I have interviewed 16 participants. [todo]to be continued

4.2 Future work: Enabling voice assistants to have robust privacy conversations

4.2.1 Overview

Past work, including some of my own described in the previous chapter, has shown that the existing notice and choice paradigm often fails to meet user needs and that incremental changes within that paradigm will not always substantially improve user comprehension or attitudes towards their decisions. We also know that current standard approaches to privacy cannot be implemented on many Internet of Things devices, wearables, voice interfaces, or other emerging technologies without a disruptive switch in modalities. Users are thought to be unlikely to read privacy information that is “decoupled” from the main interface [5, 16]. If our existing GUI-focused notice and choice paradigm is already failing users in traditional GUI contexts, we can reasonably predict that trying to apply traditional notice and choice approaches to emerging technologies will not serve users’ needs well.

4.2.2 Research questions and hypotheses

The initial phase of this study will focus on qualitative, exploratory research questions including: How do people naturally talk about privacy? What are the most natural-feeling ways that we might implement a voice interface for privacy notice and choice? In this phase, I will iterate on designs for a prototype of such an interface.

In a second phase, I will test whether this voice interface performs better than existing decoupled interfaces (e.g., the privacy interfaces in the Alexa mobile app) in terms of user needs,

user ability and effort, user awareness, user comprehension, and user sentiment. We may also be able to explore whether this type of interface better facilitates decision reversal and better avoids dark patterns or nudging patterns [].

4.2.3 Proposed methods

[This is all tentative and subject to change.]

To address the question of how people naturally talk about privacy, I would likely first run a set of qualitative study sessions in which I gave people a task that caused them to ask questions about privacy information. One option for how this could be done would be to give them a functioning smart speaker or other voice assistant, with its base software, and ask them to do a privacy task with it. However, since (as of 2022) most of these assistants can't handle many privacy interactions in the voice interface, this might have limitations. In this case, I would need to come up with some other task to elicit more examples of how people would do this *if* the interface functioned fully. [todo]Finish proposing some options here... look at papers and posters from CUI and other relevant conferences to get some ideas about co-design approaches, approaches with pairs of participants, or others that might be useful here

Next, I would have people try to interact with a functioning prototype of an Alexa Skill informed by the findings from the previous phase, and I would gather qualitative data about the usability and users' perceptions.

Finally, I would run a larger study (either online or in the lab) to get quantitative comparisons of this interface versus existing decoupled approaches.

Chapter 5

Thesis outline

5.1 Introduction

5.2 Background and related work

5.3 Past privacy choice research

5.4 User-friendly yet rarely read: A case study on the re-design of an online HIPAA authorization

5.5 A conversational approach to mobile app signup and onboarding

5.6 Enabling voice assistants to have robust privacy conversations

5.7 Conclusion

Chapter 6

Dissertation timeline

6.1 Leave/ABS time

Beginning June 2022, I will be working a full-time UX research job and will go on leave or register for ABS status. I will continue checking in with Lorrie biweekly (potentially async) and will work on the following items:

- ☐ June 2022 – December 2022: Read and summarize one paper per week for Related Work
- ☐ January 2023 – July 2023:
 - ☐ Ideate and plan for third study
 - ☐ Start preparing IRB protocol for Study 3

6.2 Return to CMU full-time or part-time, possibly August 2023

I will work that job for at least a year but after 1-2 years plan to return. I may return full-time if CMU's remote work policies evolve to allow for this, since I expect to be living in Tennessee at that point. I will also consider finding a part-time industry job that would allow me to work on my dissertation part-time while remaining in ABS status.

The timeline below is really tentative and subject to change. Overall, the goal would be to finish in a year (two semesters and a summer) or maybe just two semesters, if I'm back full-time. If I finish while working part-time, this timeline will be structured differently.

- ☐ August 2023: Finalize and submit IRB protocol for Study 3
- ☐ September 2023: Begin data collection for Study 3
- ☐ October – November 2023: Data analysis
- ☐ December 2023: Write up Study 3 findings in thesis document
- ☐ January – February 2024: Iterate on other sections of thesis document
- ☐ March 2024: Final iterations with Lorrie/committee

- ☐ Before end of spring semester 2024: Defend (and find a job)

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