ABSTRACT
A variety of applications allow users to post and share large amounts of personal information. Yet users also sometimes unintentionally expose their data to wide audiences. Users struggle to manage the sharing and protection of their personal data with current privacy mechanisms. We propose AudienceView, an alternative privacy policy interface to provide a better mental model and visual feedback for privacy management on social network sites. In this paper, we present the prototype and evaluate its performance against an existing social network site privacy interface. The results demonstrate that with our prototype users can modify a privacy policy with greater confidence, in less time.

Categories and Subject Descriptors
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms
Human Factors.

Keywords
Privacy, usability, social network sites, Facebook.

1. INTRODUCTION
A variety of applications allow people to post and share photos and documents, personal and contact information, relationships with people and organizations, location and activities, and even health status. With many of these applications, users are charged with acting as administrators for their personal information, controlling what gets shared with whom. They must determine appropriate and desired privacy policies for a wide variety of data and contexts.

A popular example of this situation is social network sites. Hundreds of millions of users now use social network sites to communicate with friends and family, strengthen social relationships, and keep in touch with old friends and acquaintances [4][11]. To accomplish this, users post large amounts of personal data, such as photos, friend lists, activities, relationship status and much more [10]. And users must also manage a potentially large and complicated set of privacy settings for all this information. Yet users do not wish to share all of their information with everyone else on the site. Thus, they must also manage a potentially large and complicated set of privacy settings.

A number of policy mechanisms have been proposed to protect people’s information in this and other settings. Yet many of the existing and proposed mechanisms rely on explicit input from the user, with little investigation into how users are able to understand and perform policy creation tasks. Policy interfaces can be time consuming and difficult to use and comprehend [14][17]. As a result, users under-utilize privacy policies, misunderstand the privacy implications of their activities, and are at risk for a variety of privacy or security problems [1][16][17].

We are investigating a new interface paradigm for viewing and modifying privacy policies for personal information on social network sites. The interface presents a privacy policy as the set of views of different audiences, where information can be shown or hidden to each audience. Our prototype, AudienceView, provides accurate visual feedback, promoting a more accurate mental model of the policy and the resulting information sharing. In this paper, we present a study comparing the performance of AudienceView against the existing privacy settings interface of the site Facebook. Our results indicate that the added and accurate visual feedback did improve users’ performance and confidence levels in modifying privacy settings.

2. MOTIVATION AND BACKGROUND
End users have to make many privacy policy decisions regarding their own information: whether photos are public or private, who has access to a music list, or which friends can subscribe to status updates. In this regard, privacy can be thought of as a process of boundary management [13], where people determine the boundaries between what is private and what is public based on the social situation. Indeed, information sharing is highly governed by the social norms of a given context [12] and privacy problems will arise when information is shared beyond the social expectations of the context. Managing the privacy of one’s personal information can be challenging, as users must decide a priori how to create policies that reflect the perceived future contexts for that information. Users tend to underestimate the size of their audience [1][17], or misunderstand the information flows and implications of privacy settings, resulting in information being shared out of the intended social context.

A prime example of these problems can be observed on social network sites [4]. Users of social network sites post and share an amazing amount of personal information. And this proliferation of personal data presents risks of embarrassment and blackmailing by revealing data unintentionally [3]. Profiles on MySpace and Facebook have been used by law enforcement and employers for investigation. And individuals put themselves at risk for serious physical or online attacks, such as stalking, identity theft, and
spear phishing attacks [16]. Many users are attempting to protect themselves by carefully posting information or restricting access to their profiles. However, users are still struggling to achieve the privacy they desire, intentionally and unintentionally disclosing too much personal information and under-utilizing existing privacy settings [17].

In security terms, privacy decisions can be thought of as discretionary access control, determining who can have access to particular information and in what circumstances. Many researchers in the information security and privacy community are examining access control mechanisms to allow users to protect their information on social network sites and other collaborative and social applications (e.g. [6][7][18]). Yet many access control mechanisms still rely on an end user to determine the policies. Thus, understanding user-policy interaction is critical to creating end-user access control mechanisms that really work.

Despite this research, relatively few have investigated interface features to improve policy management. Reeder et al. have proposed a grid visualization as a more usable and general policy creation mechanism [14]. The SPARCLE workbench has explored using a natural language interface to help users construct complex policies [5]. Our work adds to this research by examining an “audience view” mechanism, visualizing a privacy policy as the information views to various groups of people.

2.1 Facebook and privacy

Much work, ours included, has focused on the particular social network site of Facebook. In just a few short years, Facebook has grown to 250 million active users [8]. Facebook profiles include more disclosure categories than competing sites, MySpace and Friendster, and in order to create a descriptive and accurate impression on viewers, users often respond honestly and complete the majority of disclosure categories [9]. Facebook also offers extensive privacy controls to manage all profile information. A number of studies have examined Facebook to demonstrate the wide-scale disclosures of personal information such as dorm rooms and phone numbers, and the general lack of alteration of the default and permissive privacy settings [1][10].

In our own formative study, we interviewed 18 undergraduate students about their use of Facebook and privacy concerns and management [17]. We learned that users do have privacy concerns, but often struggle with privacy management and can accidentally and unintentionally disclose personal information. And one problem is the usability of the current privacy settings; users reported that the privacy interface was confusing and time consuming [17]. Additionally, the current interface has limited visual feedback, confusing language, and promotes a poor mental model of how the settings affect the profile. Even after modifying settings, users can experience difficulty in ensuring that their settings match the actual desired outcome.

The related research and our own formative work reveals the importance of the audience in users’ perceptions of their information sharing. In real world interactions, users present different facets of their identity to different audiences. Online, users attempt this same identity management task by tailoring their information for various and broad audiences [2]. Users' awareness of the broad audience of their information does initially influence them during their profile creation as they explicitly decide what they were comfortable sharing publicly. However, that awareness is reduced in day-to-day interactions with friends. Users often did not think through the consequences of their regular activities until reminded of the various audiences of their information, such as after unwanted messages from strangers [17]. Thus, we propose to improve privacy management by structuring privacy settings around the notion of the audience to help users better conceptualize the impact of information sharing and protection, enabling them to more accurately construct appropriate privacy policies for their information.

2.2 Preliminary prototype

Based on our formative research, we created simplified prototype that visualized the outcome of privacy settings from the point of view of different audiences on Facebook [15]. We then performed a pilot evaluation, asking users to answer questions about who they could see what information based on Facebook’s privacy settings and our prototype. The results showed that the visual feedback of the prototype improved users’ understanding and confidence. The study also showed how Facebook users can misunderstand settings and feel confident that information is protected when it actually is not. Overall, this study demonstrated that visualizing privacy settings as audience views have potential to improve usability. Yet, the prototype was simplified with only 3 audiences, and did not provide any mechanisms for actually modifying settings. Thus, while our preliminary work introduced the concept of an audience view, it did not explore at all the benefits and tradeoffs in actually creating and modifying privacy policies using such an interface.

In this paper we present a more functional AudienceView prototype, and a complete user study to more fully understand the impact and potential of this design. This study examines both understanding and modifying privacy settings. We also examine a more real-world scenario, where users have a larger number of audiences that they need to maintain. Our results demonstrate the tradeoffs of this method of visualizing and presenting privacy settings.

3. CURRENT FACEBOOK INTERFACE

In this study, we compare our prototype against the current Facebook interface. While Facebook has similar mechanisms to other sites for modifying a privacy policy, the site has a wider variety of disclosure categories and more privacy controls than many other social network sites. Facebook users can control the visibility of most profile information, determining whether to restrict information to friends or certain communities of users. Facebook structures information sharing around the notion of a network – the community, such as school, workplace, or city, to which a user belongs. Users can also define lists of friends, such as “colleagues” or “family”, to further customize information sharing to those groups.

For each of set of information, users can choose to share information with all friends and networks, friends of friends, just friends, or to further customize the access by allowing or limiting individual friends or groups of friends, see Figure 1. In this way, users could choose to share their phone number with just close friends, share a photo album with friends but restrict it from work colleagues, and share their education and work information with everyone.

4. AUDIENCE VIEW

To address some of the shortcomings in Facebook and other sites, we propose to structure the privacy policy interface as the
information that a particular audience – search, network, friend, or self – can see. Doing so will help the user associate privacy settings with how profile information is presented to different people, instead of with lists of privacy menus. In our current prototype, AudienceView, a series of tabbed panes presents specific views of the user’s profile for different audiences, as well as controls for showing or hiding information to that group. Thus, the interface naturally provides visual feedback as to the effect of modifying privacy settings, along with an accurate mental model of what information is shared with whom.

Other online social networking sites have implemented parts of this audience view concept. For example, Orkut provides an audience view as visual feedback on profile and privacy settings. However, while Orkut does provide this valuable feedback, its settings are somewhat limited and less complex than Facebook. Additionally, no mechanism is provided to alter any settings within the audience view. Facebook also recently introduced a preview of a profile from another user’s perspective; however, this feature is restricted to a profile view from a single friend’s perspective only. We believe by providing an interactive and expanded version of audience views, we can improve the user experience of setting privacy options and encourage greater usage.

A screenshot of our prototype is shown in Figure 2. The tabs represent audience categories – self, friend, network, and search. The chosen audiences reflect Facebook’s model at the time of the study, but could easily be altered to reflect the audiences of any particular site. A combination box for each category expands downward to reveal configured friend lists or joined networks. For each category, a representation of the user’s profile is shown, along with lock buttons for showing or hiding information to that audience. When an information field is locked, the field title is grayed out and the information hidden.

Within AudienceView, it is also possible for the user to protect categories of information. Locking categories grays out the title bar of the information box and the entire box is collapsed. This simple visual feedback gives the user a more visually accurate representation of how the audience would see the profile data, while still indicating the information is protected. The “Search” tab is a bit different, and instead shows the compact profile information boxes as they would appear in different group’s search results. Users can then show or hide the information on those boxes, or hide themselves entirely from that audience.

Currently, the prototype also provides settings for consolidated audiences: “All My Friends” and “All My Networks.” This provides the user an easy mechanism to configure settings for all friends or networks without having to configure each individual...
friend list or network. As the user applies settings in these categories, the setting is propagated to all individual audiences within the group. After applying such a setting, users are still able to visit a specific friend group or network and override any propagated setting. For example, Bob can choose to hide his address from all friends by locking that field on the “All My Friends” audience page, but then go to “Close Friends” and allow them to see his address. While implementing the prototype, Facebook added the audience of Friends of Friends. For simplicity and completeness, we added this audience under “All My Friends”, although this may not be entirely appropriate as friends of friends is a more public audience than friends themselves are. Future iterations of the prototype should resolve the best placement for this audience. However, future work should consider whether to modify the interface to reflect the current profile layout.

5. STUDY
We designed a study to compare our prototype AudienceView interface against the existing privacy settings interface in Facebook. Two profiles were used during this study which were controlled and populated with a variety of profile data and settings and replicated in both interfaces. During the study sessions, participants configured privacy settings for the actual profiles on Facebook and within the prototype AudienceView application.

We recruited students and staff at our university through word of mouth and soliciting volunteers in several courses. We sought both experienced Facebook users, and those with little or no familiarity with Facebook. Because we recruited both experienced and novice users, we discussed the concepts of Facebook networks, friends, and friend lists with all participants to ensure some understanding of Facebook audiences. For each interface, we also provided a short overview of the setting locations and allowed the participants additional time to further examine the interface, if desired.

The participants performed the same 10 tasks for each interface. Both profiles and interfaces were counterbalanced. Participants were not asked to configure settings for both task one and two, but were asked to examine the current profile state and determine what privacy settings were applied. We considered these warm up tasks to provide users with additional time to become familiar with the interfaces. For the remaining eight tasks, the participants were asked to modify the privacy settings to show or hide particular information from audiences. For each task, users were also asked how confident they were in their actions on a seven point Likert scale.

It should be noted that it might be faster and easier to configure settings for a particular interface based on how the question was designed. For example, if a person is asked to configure five items of profile data for one particular audience, such as hiding several pieces of contact information from work colleagues, this might be more easily configured using the AudienceView interface because settings are grouped by audience on one page. Alternatively, if a person is asked to configure one piece of data for multiple audiences, such as sharing an email address with close friends and family but no one else, Facebook’s setting mechanism appears faster. To examine the effects of these interface biases, we presented tasks designed in both ways. From the eight configuration-type tasks, 5 were asked users to configure the privacy of one data item for multiple audiences. Two questions asked to configure multiple items for only one audience. For the seventh task, participants were asked to configure multiple search items for multiple audiences.

We believe that AudienceView’s prototype provides the user with improved visual feedback and a better mental model of privacy settings and their outcomes. Therefore, we formed several hypotheses prior to the study:

- **Hypothesis 1.** Users will more accurately configure privacy settings using AudienceView than Facebook.
- **Hypothesis 2.** Users will have higher confidence in their task completion in AudienceView than Facebook.
- **Hypothesis 3.** Users will configure privacy settings faster using AudienceView than Facebook.

We also expected that experienced Facebook users would be more familiar with the Facebook interface and already have a better mental model than the novices. Thus, we expected that AudienceView would provide even greater improvements for novice users than for experts. Consequently, our last hypothesis is:

- **Hypothesis 4.** Novice users will experience bigger improvements in speed, accuracy, and confidence with AudienceView.

All of the participant sessions were audio and video recorded. Additionally, we utilized usability software to record mouse events and capture the screen. We used the audio and videos to analyze the time and accuracy of the participants completing the tasks.

6. Results
We recruited 28 participants for the study. Facebook's site was experiencing slowness and timeouts during the second participant's session, so we could not gather valid data. Due to this anomaly, we removed that participant’s data from the study. Of the 27 remaining, 15 participants were male and 12 were female. Twenty two participants were between the ages of 18-24, three were between 25-34, and two were 35 or older. Eight of the participants were computer science students and the remaining 19 were students of varying majors. Eleven participants reported having a Facebook account for less than six months and had rarely used Facebook. These we classified these as novice users. The remaining had used Facebook for longer and most reported frequently using Facebook. These were categorized as the expert participants. Ten novice participants and one expert participant reported not ever configuring privacy settings and only two experts reported frequently modifying privacy settings on their Facebook accounts.
Since tasks one and two were considered warm-up tasks, we do not report any statistics for either in our results. Results over all participants for the configuration tasks three through ten are shown in Table 1 with significant differences in bold.

The average accuracy represents the average number of correct responses for each task. Overall, the average accuracy for all tasks was 78% for the Facebook interface and 77% for AudienceView. We found no significant accuracy differences between the Facebook and AudienceView interfaces. Thus, hypothesis 1 was not supported.

The average confidence is the average Likert score for each task, where 7 represents “Very Confident.” For all tasks, users reported higher confidence in task completion when using the AudienceView interface, with a significant difference for 6 tasks. Thus, hypothesis 2 is supported.

The duration was calculated from the video analysis and reported in seconds. For all but one task, users completed their tasks faster in AudienceView, with a significant difference for 6 tasks. Comparing total durations for all tasks, users completed tasks in a significantly shorter period of time. Thus, hypothesis 3 is supported, users can configure settings more quickly in AudienceView than Facebook.

To further explore task completion times, Figure 3 shows a variability gauge graph for tasks 3-10 durations. Box plots add structure to visualize the differences in duration data between the Facebook and AudienceView interfaces. For a better visual representation, a line connecting the means across the different tasks has been included. This graph visualizes a consistency trend we noticed with the AudienceView interface. The grouped mean line shows an improvement of almost one half for the Facebook interface. More importantly, the connected means across task vary much less with AudienceView’s interface. It appears that with AudienceView, respondents were able to apply learned skills from previous tasks to help with subsequent tasks. The Facebook interface did not exhibit this same attribute. For example, learning how to configure privacy in AudienceView for a data item such as the mobile phone uses the same method as applying the privacy setting for a photo album. However, with Facebook, these two items are on completely different pages and use different methods to apply a setting. Additionally, Facebook offers multiple paths to reach the privacy page for photo albums and no path was easy for respondents to locate.

Earlier, we mentioned different ways of formatting task questions that could appear to be configured easier with a particular interface. This was determined by classifying the tasks by identifying the number of data items to configure for the total number of audiences. Applying settings for single data item with multiple audiences would mechanically favor the Facebook interface, while multiple data items for a single audience would mechanically favor AudienceView. For example, we asked respondents for task eight to configure the profile to only show status updates to all of the owner’s friends except the “Shady Friends” group, and to not show status updates to any network. When starting from the privacy settings page in Facebook, the respondent would need to execute three mouse clicks, type three letters and execute two additional mouse clicks. In AudienceView, the respondent would need to check each audience page to configure and then verify that status updates were viewable by all friends, except “Shady Friends” and not viewable by any networks. This could be done with a minimum of 13 mouse clicks using AudienceView’s interface. Even with additional clicks needed to complete a task in AudienceView, participants were able to execute the tasks faster. Figure 3 also highlights the large differences that occurred in task completion time for tasks 9 and 10, which mechanically favored AudienceView.

We then examined our results for any ordering effects of interface presentation. The only evident effect we found was with confidence levels. Participants who started with Facebook reported significantly higher confidence for Facebook than those who started with AudienceView (F = 18.03, p < 0.0001).

We then examined the differences between novice and expert participants in our study. We found no differences between novices and experts in accuracy. However, for confidence, we did find that the mean difference in confidence between the two interfaces was significantly higher for novices than experts (F = 22.04, p < 0.0001). This is because novice participants were significantly less confident with Facebook than the experts (F = 23.05, p < 0.0001), although there was no difference in confidence between novices and experts for AudienceView. This indicates

<table>
<thead>
<tr>
<th>Task</th>
<th>Average Accuracy</th>
<th>Average Reported Confidence</th>
<th>Average Duration (Seconds)</th>
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<tbody>
<tr>
<td></td>
<td>Facebook</td>
<td>Audience View</td>
<td>Facebook</td>
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<tr>
<td>Task 3</td>
<td>37%</td>
<td>41%</td>
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<td>Task 4</td>
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<td>Task 5</td>
<td>81%</td>
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<td>Task 6</td>
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<td>Task 7</td>
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<td>Task 10</td>
<td>85%</td>
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* Bold results reflect statistically significant differences at the 0.01 level using the Student’s t-test
that novices did experience a greater improvement in confidence, as they were equally confident with AudienceView and less confident with Facebook than the participants with much greater familiarity with Facebook. Finally, novices were slower at completing tasks in both interfaces, but they did not experience greater improvements with AudienceView. So, overall hypothesis 4 is not supported for accuracy and duration, but is supported for confidence.

After close analysis of the respondent sessions, we noticed a general trend that most respondents seemed to put forth more effort when asked to “configure” as opposed to only “observe” settings. As a result, few respondents “gave up” on the configuration tasks early and occasionally would spend large amounts of time to accomplish the tasks. This varied from our earlier study [15], where, if respondents could not quickly observe the correct answer, they would guess and report a lower confidence. However, several participants using the Facebook interface did discover settings locations in later tasks that were needed previously, where they had either configured the setting incorrectly or not at all. These participants then temporarily abandoned their current task and reverted back to the previous task to correct the answer. These situations are not represented in our numerical results, as we reported accuracy and confidence for the final answer, and calculated the overall duration of the task. None of the respondents needed to address previous tasks with the AudienceView interface.

There were several prominent causes for longer task completion times with the Facebook interface. Many respondents had difficulty actually finding the setting that corresponded to a particular data item. More specifically, participants found it difficult to locate settings for applications and photo albums. While Facebook provides multiple links to access the application privacy settings page, many respondents struggled to quickly find how to access the page. Some of the more experienced Facebook users were able to remember where the links were and did navigate more quickly to the settings page. In contrast, we noticed smaller duration times when users were able to quickly find the location of a setting in the Facebook interface. For instance, participants configured privacy for the email address rather quickly in task four. This was likely because we asked participants about the email address in task two. They appeared to remember the setting’s location. However, we noticed this was not true for all tasks and data items. For example, task three and task ten involved participants modifying settings for two separate photo albums. Several participants who correctly completed task three by accessing the photo album settings page struggled to find that same page while working on task ten.

We observed another difficulty as participants hesitated while trying to determine how to properly configure sets of friend groups. For some data items, the customized setting’s pop up window has fields for “All friends except...” and “Only these friends...” where users can include or exclude friends or friend groups. Some respondents with a more technical background appeared to be more proficient at making this calculation quickly, but most paused noticeably to construct a mental model of the sets of friends. AudienceView’s propagation method appeared to be easier to understand, as users seemed to have little trouble applying a setting to all friends or networks, then adjusting a specific audience page for exceptions.

In a post-session interview, we asked respondents to comment on which interface they preferred and why they preferred that interface. All participants indicated a preference for the AudienceView interface. Additional comments supported their preferences. For example, P15 wrote:

“I definitely liked the prototype interface. I felt I had more control over my privacy settings.”

P14 remarked:

“I think the prototype was more straightforward than Facebook's interface.”
6.1 Limitations
While we attempted to recruit a variety of participants, the majority who volunteered were college students. Thus, our results may not generalize to a wider population. In addition, because we were comparing against an existing interface, users may have been biased by their knowledge that AudienceView was our experimental interface, and been more positive about the prototype. Follow up studies would be needed to further generalize our results.

7. DISCUSSION
To summarize our results, users configured their privacy policies faster and with improved confidence with AudienceView. We were surprised, given how much users seemed to struggle in Facebook, that accuracy did not improve in AudienceView. Unlike our pilot study, users did not give up on completing a task, and instead took a longer amount of time in Facebook, with several participants even returning to previous questions. Thus, users are capable of using the existing policy interface if they take enough time and effort. However, the more time and effort required to create privacy policies, the less likely users will be to do so. Many inaccurate answers for both interfaces appear to have been caused by misreading or reading the question too quickly, so the participant would forget to configure one of the audiences before completing the task. This happened frequently in both interfaces, but would not likely be a factor when an individual is modifying controls for their own desires.

Participants’ comments after the sessions also reflected that their improved confidence impacted the preference for the AudienceView interface. Thematically, participants expressed that AudienceView provided less uncertainty and more control, as P16 comments:

“I thought the prototype was easy to use and very effective. It didn’t have the uncertainty that the Facebook interface does.”

We believe this confidence is provided by the visual feedback that an audience view affords. To prepare the study, we frequently used multiple Facebook accounts in an attempt to verify the outcome of applying different privacy settings. AudienceView provides that immediate visual feedback, which improves the user’s model of how information is viewed and hidden to their configured audiences. We believe that simply providing a passive audience view to check on the outcome of settings is helpful, but not sufficient. Facebook does have a feature to allow users to view their profile from the perspective of an added friend, and while this feature was already available during the study, none of our participants actually used it to aid in completion of the tasks. Users might not have noticed the location of this feature, but it is also one more step they would have needed to perform on top of what was already a lengthy configuration process.

In comparing the novice and expert participants, it was also interesting that the experts did not perform much better than the novices. Even with years of Facebook experience, many participants were not that familiar with the privacy settings interface. There are several explanations. Users might never have tried to modify their privacy settings. While this seemed to be the case early in Facebook’s history [10][17], later surveys have indicated that most users report modifying at least some of their settings [11], as our experts did. However, Facebook is evolving rapidly and making frequent modifications to the interface, reducing familiarity. Facebook’s interface also appeared to be difficult to learn and remember. While remembering the location of a setting did improve performance, our participants had difficulty remembering the locations of some settings even within the same 20 minute session! The location of a privacy checkbox or menu, even when grouped thematically, does not appear as memorable as the very visual layout of the information on the profile page and AudienceView. Additionally, if the layout on AudienceView is very similar to the layout users see every day, such as while viewing other users’ profiles, their regular activities will inform their use of the privacy policy interface. This is not the case with Facebook’s current settings interface.

AudienceView tested the effectiveness of a common HCI tradeoff. While it might require users to execute more mouse movement and clicks to perform certain tasks, less cognitive effort is needed to complete the tasks. Facebook’s current interface forces users to hunt for pages and carefully think about the implications of menu choices and customized setting options. This represents a transfer of a Facebook cognitive problem to a slightly more complex mechanical method used by AudienceView. Designers should consider this tradeoff in proposed interface designs and evaluate even simple cognitive costs associated with interface mechanisms.

AudienceView is not without limitations. The effectiveness of the design depends on having a relatively small number of audiences. Even with the implemented propagation of settings, it might be overbearing for a user to click on many views just to verify who can see what information. There is also another limitation with the propagation/override model. By allowing overrides, the user could experience a false sense of applying a setting to an aggregated group. For example, if a user were to override the “Close Friends” friend group, but want to apply that same setting to “All Friends” later, the user would need to manually undo the override. Implementing a third state to the aggregated group lock icon with a partially configured state would give additional visual feedback to the user indicating not all composite audiences are configured.

AudienceView does not provide all of the functionality of the Facebook policy interface and other similar interfaces. Future versions would need to identify where the audience view interface metaphor would still apply and where additional settings would still be needed. For example, how much do users wish to configure settings for one individual friend and how should they do this? Many social network sites are also becoming less focused on descriptive fields of personal data, and moving towards a focus on social and profile interaction with data flowing from friends as event and news feeds. Facebook has additional privacy settings to control what types of information is syndicated. Currently, AudienceView does not address this type of personal information flow. Future work includes investigating similar privacy mechanisms to control event syndication. Finally, as profiles grow, how closely should the view resemble reality, or could settings pages be simplified with a condensed version of a profile view while still providing full functionality?

We believe this abstraction of an audience view can apply to many domains where users must manage their personal information in a social context. Developers of any online social site that is involved in sharing personal information can apply the abstract principles of AudienceView to achieve more effective privacy management. We are also interested in investigating whether the concept of an audience would be useful beyond
groups of people to organizations and sites. For example, social applications or sites accessing profile data could also be visualized as an audience. An audience view type of interface may strengthen the users’ mental model of how other applications or organizations access personal information.

8. CONCLUSION AND FUTURE WORK

Users should be able to fully participate in the benefits of sharing personal information by having full control over sharing and protecting their personal information. Applications need usable privacy controls to enable users to more fully reflect the nuanced privacy we exhibit in physical social situations. We have examined and evaluated a novel interface for managing personal information on social network sites. Our results indicate that the improved visual feedback in the form of information sharing to different audiences does lead users to more quickly and confidently modify privacy settings. These results might have two consequences. First, for users who desire greater privacy, a more usable interface may help them increase their privacy protection, reducing their risks and helping them feel more comfortable sharing information. Second, for those who already have restrictive settings, the interface might encourage them to more selectively share certain pieces of information with wider audiences, improving their social experience. Ideally, all users would have an increased and accurate understanding as to what information they are sharing with whom.

While our results are encouraging, we have only examined our prototype against one particular social network site. To generalize our results, we need to more fully examine the range of privacy policy interfaces, and how well the audience view concept will work across a range of applications. We also need to explore interfaces for controlling information flow, such as news feeds, as well as controlling access by entities that are not people, such as applications. We continue to investigate new interfaces and mechanisms for improving privacy and security management.

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10. REFERENCES


