What Do You See? An Eye-tracking study of a Tailored Facebook Interface for Improved Privacy Support

Moses Namara
Clemson University
Clemson, SC
mosesn@clemson.edu

Curtis John Laurence
Clemson University
Clemson, SC
clauren@clemson.edu

Abstract

In this study, we examined differences between the gaze patterns and areas of interests on the default Facebook interface and a derivative prototype of Facebook's main interface called "Fakebook" being developed to examine the efficacy of adaptation methods (Automation, Suggestion and Highlight) for the provision of user tailored privacy support. These adaptation methods could be utilized to adapt Facebook's privacy features to the user's personal preferences given that they generally find it difficult to translate their desired privacy preferences into concrete interface actions. Thirty participants were asked to find and delete posts that do not reflect their true selves while their gaze was tracked with an eye tracker. Each participant saw a total of five images, the first two to examine for differences between the two interfaces (default facebook and Fakebook). The other three images were used to test the effectiveness of the adaptation methods. Results showed that there were not any substantially significant differences in the gaze patterns and areas of interest between the two interfaces. Apart from the Chat area which was more pronounced in the Fakebook interface, the Menu and Advert areas were the two common areas of initial interest and gaze between the two interfaces. The Suggestion adaptation method had the most fixations and sustained user gaze the most as compared to the other adaptation methods. We discuss these findings and the importance of their use in improving privacy support across social media sites such as Facebook.

Keywords Eye tracking, Gaze, Fixation Length, Privacy, Privacy on social media, Facebook

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1 Introduction

User Privacy is one of the most important issues of the 21st Century that ought be taken seriously to ensure users safe guard their privacy whilst using online services. This is more evident on social network sites such as Facebook where enormous data that is personal in nature is shared not only with close friends and acquaintances but with anyone including people off of Facebook. Despite the fact that Facebook has plenty of privacy controls and features in place to give its users more control over their privacy settings, users still have a hard time translating their desired privacy levels into concrete actions [13, 16]. As such they avoid and or steer clear of utilizing the available controls on the platform due to a misunderstanding of the social network coupled with usability issues [12, 15]. For instance users don't often remember who will see their Facebook content particularly new users who have trouble understanding how the Facebook platform works and also experienced users who are often caught by surprise [12].

Researchers have proposed making privacy functionality adapt itself to users privacy preferences through approaches such as User-Tailored Privacy (UTP) [5] . Here, a system's privacy settings are automatically tailored to the user's privacy preferences and actual desire for privacy. In this regard, we developed a working prototype of the Facebook platform that we called "Fakebook" to investigate three adaptation methods (Automation, Highlight and Suggestion) that could be used to tailor the privacy settings. These adaptations can facilitate the privacy functionality of a system such as Facebook to support its' users privacy decision making. Fakebook is less cluttered as compared to Facebook since it consists of only the basic features such as a NewsFeed, Chat, and settings page that are relevant to investigating the three adaptive methods.

The purpose of this study is to identify the platform features of Facebook that users seek in order to warrant some

form of consistency with Fakebook. This will lend to the generalization of our findings using Fakebook to Facebook. In line with this goal, we pose the following research questions

RQ1: What are the initial gaze patterns and areas of interest that draw the attention of a user on the default Facebook versus Fakebook?

RQ2: Which of the three adaptation methods on Fakebook are most effective in sustaining user's gaze?

RQ3: Which of the three adaptation methods on Fakebook get more user fixations?

We hypothesize that there won't be much difference in gaze patterns between Fakebook and the default Facebook platform, and that the automatic adaption will get less user fixation as it takes longer to find compared to the other adaptation methods. Furthermore, the suggestions adaptation will sustain user gaze due to it's conspicuousness but the highlight adaptation will have more user fixations due to it's visual prominence.

In the remainder of this paper, we first present a background on our work, then describe our methodology and finally discuss the findings and directions for future work.

2 Background

Eye-tracking can be a useful tool for observing how the design of an interface affects user attention, fixation, and comprehension of a subject matter. An eye-Tracking study on how users read privacy policies showed that when users are presented with an option to simply agree to the policy, they generally do not read the policy [7]. Another study found that regardless of how a privacy policy is presented to users, they still have very low comprehension about the policy [11]. These points together suggest that the way privacy information is presented to the user, as well as how it is structured, is important for user comprehension of said information, speaking to the motivation of this research.

The experiment described in this paper investigates adaptations that can be used to present users with in time active privacy features. Research suggests that timing and design of computer-mediated instructions and system warnings affect user responsiveness [3]. The methods described in the aforementioned study follow a theme, limiting user ability to ignore the message increases the user's responsiveness to the message. One method discussed in this paper involved the use of suggestion aided by virtual character such as a cartoon or animation to make the message presented to the user more friendly. The idea being if the user has a positive reaction to the cartoon or animation, they would find it less disrupting or irritating and be more responsive to the message. Previous Eye-Tracking research supports this theory [2].

The use of images to increase user engagement is thoroughly supported by previous works explored. One study has shown that on Social Media platforms, users' intent to engage with content by clicking or sharing increases when the post has an image, especially if the image is a positive one [4]. Another study supports this, but goes further by indicating that images enhance attention especially for social or news posts [10]. Finally, a study on the Facebook platform itself suggests that the size of the image in a news post is extremely important to attract and retain readers [9].

Privacy information is generally considered to be important or sensitive, so it stands to reason that users may pay closer attention to this information than other content on Social Media. An Eye-Tracking study on Social Media has found that the location of information is highly critical, and that information displayed in areas that receive the most visual attention is read most of the time, regardless of the level of topic sensitivity [8].

3 Methodology

3.1 Experimental Design

In this experiment, a within-subject design was used to investigate the adaptations for user privacy support in Fakebook . Five different stimuli (Figure 1-5) was presented to each participant. All the stimuli examined the privacy feature of post deletion for proper user reputation management. The stimuli in Figure 1 and 2 were used to investigate **RQ1** and whereas Figures 2 -5 were used to investigate **RQ2** and **RQ3**. Participants were shown a blank screen in between each stimuli to counteract for the similarities in the images. Furthermore, the images were randomized to counteract ordering effects. Data collected during this study, included the fixation time, first time view and average time viewed for each areas of interest to held determine that hold the participants gaze the most.

3.2 Stimuli

The stimuli used for this study are a screen-shot images of Facebook's main interface [1] (Figure 1) and four identical screen-shot images of a derivative prototype of Facebook's main interface called "Fakebook" (Figure 2-5). Figure 1 is the default image taken from the main Facebook site cite. It contains a "NewsFeed": updates about what a users' friends are saying and doing on Facebook in the middle column. Updates can also include a users own recent posts. At the right top column are "Stories": mini-video updates from a users' friends that stay view-able for 24 hours. In the middle right are updates of a users' page(s) if they are a page administrator. This is followed by a watch-list of videos from content creators a users follows with a "Chat" feature that enables a user to direct message their friends in the lower right corner. In the left column are shortcuts to other various features that Facebook offers such as"Messenger", "Watch", "MarketPlace" etc.

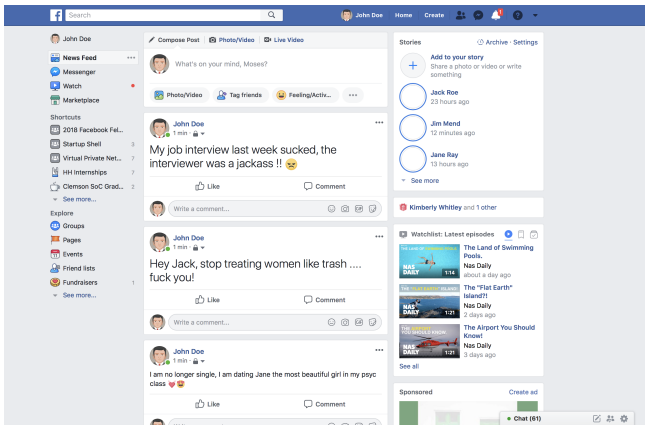


Figure 1. Stimuli of the default Facebook page.

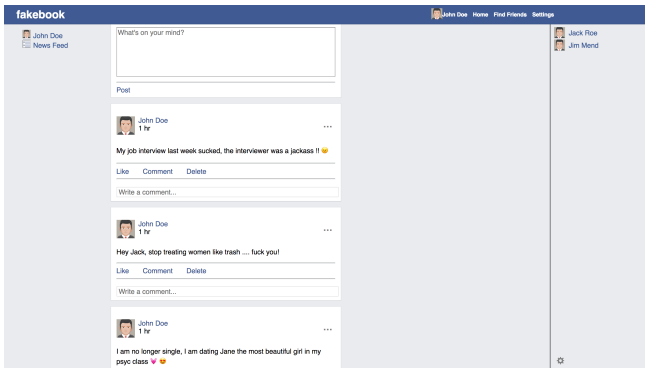


Figure 2. Stimuli of the modified Facebook page i.e Fakebook.

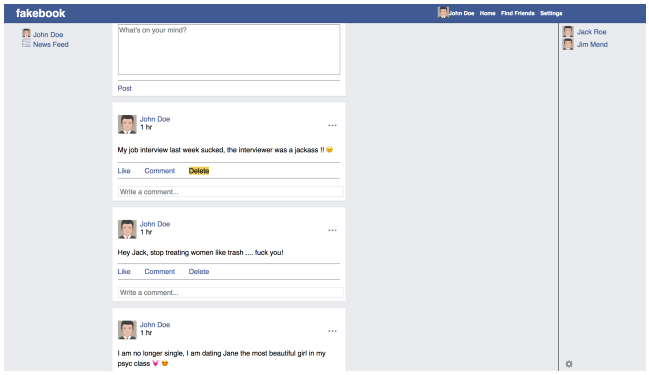


Figure 3. Stimuli of Fakebook with the Highlight Adaptation.

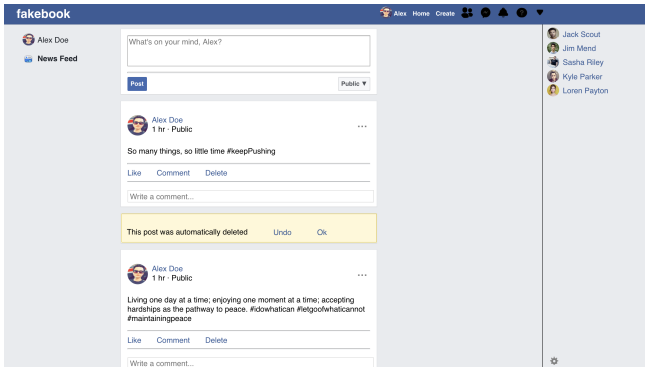


Figure 4. Stimuli of Fakebook with the Automation Adaptation.

Figure 2 is an image of the modified version of the Facebook Interface (Fakebook) developed by the authors to investigate adaptation behaviors [6]. Compared to Figure 1, it is less cluttered and only contains features (NewsFeed and Chat) which are relevant to investigating the three adaptive methods and main privacy user behaviors[14].

Figure 3 is an image of the Highlight adaptation method that increases the visual prominence of the action that the adaptive procedure predicts the user would aspire to take to protect their privacy. This is done through a color change i.e yellow background color to betoken the action a user should consider.

Figure 4 is an image of the Automation adaptation method which executes automatically, then necessarily informs the user to either undo or accept the action taken. This method operates completely outside of the user's awareness. For example the system automatically deletes a post from the NewsFeed and informs the user about the action taken. Such a post could be of any kind deemed to violate the users privacy.

Figure 5 is an image of the Suggestion adaptation method which through an "agent" (virtual character) such as Facebook's Privacy Dinosaur verbally suggests a recommended action to the user. The provided options "OK" and "Rather Not" allow the user to either accept or reject the recommended action.

3.3 Apparatus

Participants interacted with the stimuli displayed on a 22" Dell monitor with a (1680 x 1050) resolution. A Gaze Point GP3 Eye Tracker was mounted beneath the monitor. The Gaze Point GP3 is a pupil center corneal reflection (PCCR) eye tracker which emits infrared light towards the eye and tracks the corneal reflection in order to measure the eye position. The device offers an accuracy of 1 degree of visual angle and collects data at a sampling rate of 60Hz.

3.4 Participants

Thirty undergraduate and graduate students (22 Males, 8 Females, Age M = 23.5, SD= 4.28) at Clemson University volunteered to participate. All participants had normal vision with no visual impairments, and all read the informational letter of consent prior to participating. They were all Facebook users.

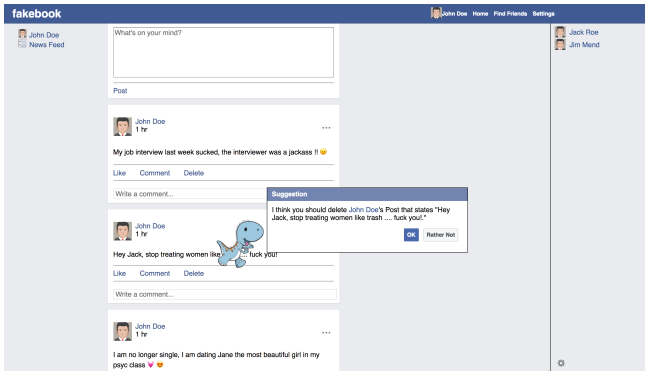


Figure 5. Stimuli of Fakebook with the Suggestion Adaptation.

3.5 Procedure

Participants were asked in-person or via email to take part in this short eye tracking study. On agreement to participant in the study, an experimental session date and time was arranged based on the participant's availability. On the experiment day, participants were greeted by the researchers and escorted to a computer lab. They were seated in front of the monitor coupled with the Gaze Point GP3 eye tracker and provided with the informational letter of consent. Each participant, was then asked to complete a pre-experimental demographic questionnaire in which they noted their age, gender,any visual impairments and their usage and familiarity with Facebook. Upon completion of the questionnaire, participants completed a 9-point calibration task built into the Gaze Point software. An experimenter validated the calibration by asking participants to look at specific locations on the screen while their estimated gaze was displayed in real time on the screen. When the software's estimated gaze was inaccurate, the 9-point calibration was repeated and retested. An experimenter verbally presented a brief overview of the experiment followed by the instructions. Participants were provided a scenario in which they were on searching for a job. The scenario was: "*You are John Doe from Fresno, California. You are <X> years old, and regularly use Facebook for business and leisure. You are currently looking for a job and are trying to keep a clean Facebook account. You would like to <use privacy feature> to achieve <some goal>*" . They were then instructed to view a series of images (See Figures 1-5) to see what action they would take based on the posts within those images. For each image, they were asked to identify and point out which of the visible posts did not reflect their true selves and thus were more likely to delete in order to reflect a proper self and be a good candidate for the job with regards to the potential employer. After each image, they were asked to mention out-loud what stood out about the image and the reasoning behind their choice on which post to delete. The experiment lasted about 10 minutes after which they were thanked, debriefed and then dismissed.

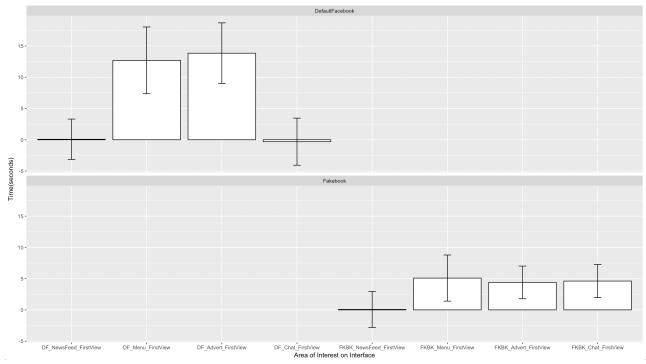


Figure 6. Bar graph showing the mean first time to view and effect sizes for each of the AOI's across the Default Facebook and Fakebook interfaces.

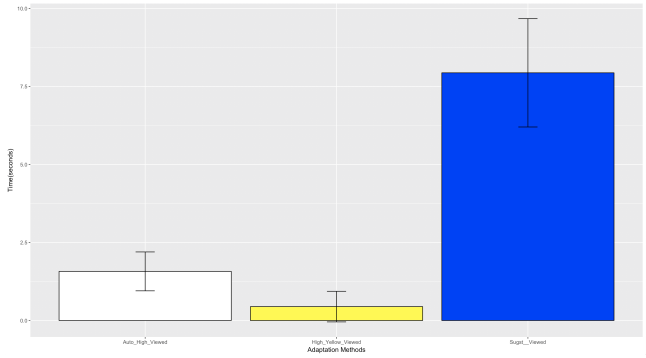


Figure 7. Bar graph showing the mean and effect sizes total time viewed for each of the three adaptation methods.

3.6 Data Extraction

For each trial, a participant had a one minute to view each image. The number of fixations, first time to view (to help learn about the time and areas of initial fixation), total time viewed (to help learn about the areas of most interest) were extracted from the raw data. The total number of fixations was be calculated via the Gaze Point software. Areas of Interest (AOI's) were manually drawn around the adaptation methods in Figure (3-5) and within the two main interfaces (Figure 1,2) under test. The time of first view was calculated as the time from presentation of the image to the time of first eye view falling partially or fully within the AOI and was extracted from via Gaze Point software.

4 Results

Using the multivariate test of a repeated factorial ANOVA, the between-subjects differences were first removed from the data for each test to reduce the likelihood that the results would differ based on the participant groups such as the basis of gender (male or female) and or Age (young or old).

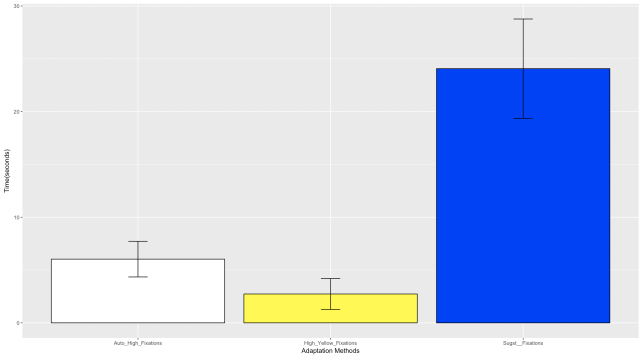
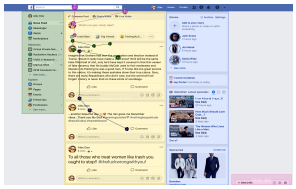
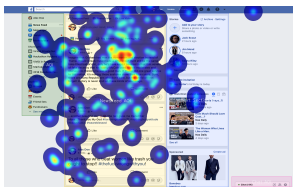


Figure 8. Bar graph showing the mean fixations and effect sizes for each of the three adaptation methods.



(a) Default Interface fixations



(b) Default Interface gaze heatmap

Figure 9. Default Facebook Interface: fixations for three participants in (a) and average fixation heat map for all the participants in (b).

4.1 Initial Gaze Patterns and Areas of Interest

To assess the initial gaze patterns and areas of interest that draw user interest on the default Facebook versus on Fakebook interface, an lme was performed using the extracted time to first view for each of the area of interests within the two interfaces. Results showed that participants viewed the areas of interest in the Default Facebook three seconds faster than those in Fakebook interface indicated by a significant pairwise t-test,b = -3.039, t (29) = -2.63 , p <.01 and thus the type of interface viewed had a significant effect on participants' initial gaze pattern across the areas of interest under test, X2(4) = 8.61 p=.003. On average, in the default Facebook interface (see Figure 1), the Menu (M=12.71,SD=15.88,t(203) = 6.5 , p <.01) and the Advert (M=13.85,SD=14.51, t(203) = 7.1 , p <.01)were significantly the first AOI's to view (as compared to the NewsFeed) with a comparable non-significant time to first view between them (Menu and Advert) b = 1.142, t(203)=0.597 ,p = 0.998 (See Figure 6). On the other hand , in the Fakebook interface (see Figure 2) there was no significant effect on the first time to view AOI's among all the four AOI's even when compared to the NewsFeed AOI i.e the Menu (M= 5.09,SD = 10.74,t(203) = 2.62 , p =.146), the Advert (M= 4.40,SD=9.45, t(203) = 2.26, p=. 314) and Chat (M=4.61 , SD=8.51,t(203) = 2.38, p=.25) AOI's (See Figure 6). However, the Menu AOI seemed to be among the first to viewed on average in this interface.

4.2 Sustained User Gaze

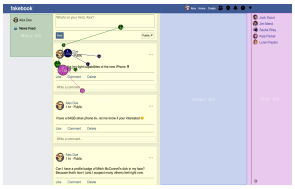
To assess which among the three adaptation methods i.e Automation (see Figure 4) ,Highlight (see Figure 3) and Suggestion (see Figure 5) on Fakebook are most effective in sustaining user's gaze using the extracted data on time viewed. A paired samples t-test using lme showed that the type of adaptation method viewed had a significant effect in sustaining a user's gaze X2(2) = 74.65, p<.001. Overall, the suggestion adaptation method (as compared to the Automation method), was the most effective method in sustaining users' gaze with a significant time effect b= 6.36, t (58) = 8.35, p <.001 as well as when compared to the highlight method, b =7.49, t (58) = 10.00, p <.001 (see Figure 7). In trying to sustain a user's gaze, the Automation method is comparable though higher than the Highlight method with a non-significant effect b=-1.129, t(58) = -1.48 p =.14.

4.3 Fixation Duration

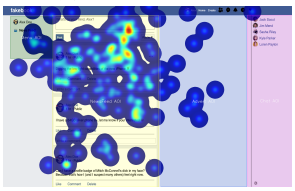
To assess which of the three adaptation methods on Fakebook got more user fixations measured using the extracted data on the number of fixations. A paired samples t-test using lme showed that the type of adaptation method had a significant effect on user fixation X2(2) = 74.65, p <.001.The suggestion adaptation method (as compared to the Automation method), got more fixations with a significant time effect b = 18.03, t (58) = 8.68, p <.001 c even when compared to the highlight method, b = 18.033, t (58) = 8.83, p <.001 (see Figure 8).The Automation method fixations were comparable though higher than the Highlight method with a non-significant effect b= -3.30, t(58) = -1.59, p =.11.

5 Discussion

The results for each of the dependant variables (task time, number of fixations, and time to first view) across the AOI's followed a similar pattern, but most of these patterns varied in significance. We expected that there would not be much difference in gaze patterns between the default Facebook and Fakebook interface. This hypothesis was supported as we found that the Menu and Advert were the first areas to attract initial user gaze within the default Facebook interface. This could be because user's wanted to learn more about the user profile of the persona used. Furthermore, the Advert area contained stories profiles, sponsored ads and three video thumbnails that would instantaneously attract attention. At



(a) Fakebook fixations



(b) Fakebook gaze heatmap

Figure 10. Fakebook Interface: fixations for three participants in (a) and average fixation heat map for all the participants in (b).

this point the News-Feed and Chat areas were still of less interest or of use to the participant. However, as they began to execute the task, we found that most of the fixations were within the News-feed area both within the default Facebook and Fakebook interfaces (See Figure 9,10). Presumably to enable participants execute the instructed task that involved reading and discerning which posts to delete. Interestingly within the Fakebook interface we found that in addition to the Menu and Advert (which was blank in this case) areas , the Chat area was also of interest. This could be on virtue that unlike in the default Facebook where chat was minimized (see Figure 1), here it was maximized and thus revealed the user profiles of the persona's friends who would be online and available to chat (see Figure 2). Overall, from the initial gaze pattern, we found that the menu, advert and chat areas were the initial areas of interest. However, the areas within default Facebook interface were first to viewed three seconds faster than those in the Fakebook interface.

We also expected that the automation adaptation method would get less user fixation as it takes longer to notice compared to the other adaptation methods. This hypothesis was partially supported in that automation indeed got low fixations but the highlight adaptation method got the lowest fixations. We believe this was because the highlight method covered a small area within the interface and thus would have been easy to miss as compared to the automation method that covered a bigger area. From the pilot test, we also redesigned the automation method (see Figure 4) to make it more apparent by adding a highlight for some visual prominence otherwise it would have completely been missed. Overall, the suggestion method got the most fixations as compared to all the other adaptations.

Finally, we expected that the suggestion adaptation method would sustain user gaze the most compared to the other adaptation methods due to it's conspicuousness. Indeed this hypothesis was supported.

5.1 Limitations and Future Work

Due to the task that users were required to execute (find and delete posts they would be uncomfortable with), we found most of the fixations were within the NewsFeed AOI in both the Default Facebook and Fakebook Interfaces (Figure 9, 10). However this was not surprising as the NewsFeed serves as the main area of interest on most social media platforms and for most users it is where they get updates on news or friends life achievements and progress. Future work could investigate if this kind of fixation behavior extends to other areas within social media interfaces when the tasks are changed.

6 Conclusion

In this experiment, we asked participants to find and delete posts that do not reflect their true selves. Deletion would not only preserve their true selves and safeguard their privacy but was also a reflection of their user privacy preferences i.e what they would be comfortable sharing or disclosing versus what they would not. We measured overall task time, number of fixations, and time to the first fixation to learn more about user gaze patterns. The results of thus study indicate how different adaptation methods can be utilized to facilitate user privacy decision making on social media sites. We recommend that web designers and developers adopt and incorporate these methods to improve user privacy online.

Acknowledgments

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