

A User-Centered Design Approach to Develop a Privacy Awareness Application

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Abstract: There are more than 50 million Facebook users in Bangladesh. Despite its wide usage, Facebook has resulted in negative impacts on individuals and the community, mostly due to improper use of the media. In our prior research, from a survey of almost 200 Facebook users in Bangladesh, we found that some Facebook users had (1) diverse demographic characteristics, (2) varied levels of understanding, and (3) reluctance to learn the features needed help to understand the features to use Facebook properly. In this research, we designed a low-fidelity prototype with interactive video tutorials and quizzes to help them improve their awareness of privacy on Facebook, especially with complicated privacy settings. We conducted a detailed usability evaluation and collected feedback from eleven participants and adjusted the prototype based on the received feedback. Once developed the application will be helpful to improve the overall Facebook experience of users in Bangladesh. We also reflect on the experience of the User-Centered Design (UCD) and recommend how UCD can be planned for other similar user groups.


1 INTRODUCTION


Bangladesh was 8th globally in terms of Facebook users April 2024 (Dixon, 2024). Due to the recent “Digital and Smart Bangladesh” initiatives of the government in the country, digital devices have become easily accessible and Facebook is competent to be used by anyone (Knautz and Baran, 2016). All these made Facebook the most popular social media in the country which has brought numerous benefits to the lives of people in Bangladesh, including F-commerce to empower women (Zabeen et al., 2013; Basak, 2022). However, Facebook has had many negative consequences for society, including spreading misinformation and breach of privacy (Ali, 2020). A major reason behind the negative consequences is an insufficient understanding of privacy, which is often influenced by the varying digital literacy (Kanij et al., 2023) and complicated privacy settings (Kshetri, 2011).

To understand the perception of privacy among the general population of Bangladesh, we conducted

a broad survey where we identified three groups of Facebook users - (1) understand the privacy features and use those properly, (2) do not understand the privacy features very well and are reluctant to learn new features, and (3) understand the privacy features, however, do not use those properly. The second and third groups of Facebook users needed some help to improve their privacy protection behavior, for that we developed an interactive quiz-based application.

As suggested by Grundy et al., diverse user characteristics should be incorporated into the process of designing and developing any software solution for diverse end users (Grundy et al., 2020). Therefore, we followed a User-Centered Design (UCD) approach to develop an interactive privacy awareness application for the diverse Facebook users in Bangladesh. The UCD approach recommends that solutions be designed iteratively and incrementally together with users. In this research, we developed a low-fidelity interactive privacy awareness application prototype and evaluated the interface with eleven participants. Based on their feedback, we improved the application. Once developed, the application will help Facebook users in Bangladesh understand the complex privacy settings. Reflecting on our UCD process with

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Facebook users in Bangladesh, we also recommend to future researchers and developers how UCD can be used for other diverse end-user groups.

2 BACKGROUND

User-Centered Design (UCD), introduced by Norman in the 1980s (Norman and Draper, 1986), is the concept of ensuring user participation throughout the design process (Abrás et al., 2004). Initially used in Human-Computer Interaction (HCI), UCD has been adopted to software development methodology where end-users are placed at the center of the process (Lowdermilk, 2013). The benefits of UCD include the sense of ownership, higher satisfaction, and chances of adoption by the end-users (Preece et al., 2015). Some prominent UCD principles are Norman's seven principles (Norman, 1988), Shneiderman's eight golden rules (Shneiderman, 1986), and Neilsens's heuristics (Nielsen, 1995). All the principles emphasize simplicity, visibility, ease of learning and use, precise mapping between action and effect, and feedback and interpretation (Abrás et al., 2004).

User Modeling: Persona. A persona represents a group of end users of a software application (Grudin and Pruitt, 2002). A persona is often described with names, images, and demographic information (Pruitt and Adlin, 2010) and background, goals, interests, and frustrations (Cooper, 1999). Personas give a real impression of the end-users and help developers build empathy with them. Usually, there are three broad approaches to persona development: qualitative, quantitative, and mixed (Tu et al., 2010). The qualitative approaches include exploratory user research with a medium sample size to understand end-user characteristics and behaviour through an iterative process (McGinn and Kotamraju, 2008). Quantitative persona development approaches focus on a large pool of data collected through surveys, online data sources, and algorithmic analysis (Jansen et al., 2022). The third and final approach is called the mixed approach, which combines quantitative and qualitative approaches, usually targeting one end-user group such as the elderly (Cooper et al., 2007). One of the most popular ways of developing personas is Nielsen's ten-step process for persona development, which is considered a generalized mixed method for developing persona (Nielsen, 2004).

Design Solution: Prototypes. A prototype is an early-stage design of an application. The design can be presented as sketches on paper, with diagrams or the frontend interface. Some of the purposes of having prototypes are to communicate the design idea,

to get early feedback to refine the designs, explore new design ideas, and learn more about the design space (Camburn et al., 2017). Prototyping can be iterative, where design is refined through iterations (Reed Doke, 1990). Prototyping can also be parallel, where different designs are developed independently to compare and select (Borowski, 2012).

Usability Evaluation. Usability evaluation is the process of evaluating the design solution (prototype). This can be conducted as a laboratory study with or without real users (heuristic testing), as field studies to understand the users' experience, and as a hands-on measurement to find usability measures (Nayebi et al., 2012). A usability evaluation including real users gives them some tasks to complete on the design solution.

3 RELATED WORK

Privacy and Facebook: Privacy on a social media platform has always been a matter of concern. However, after the Cambridge Analytica incident, privacy related to Facebook brought the issue into the limelight (Senate, 2018). A review of Facebook privacy-related literature indicates that the privacy protection behavior of Facebook users is influenced by (either as causal or as consequential) several aspects such as "threats", "understanding of privacy settings provided by Facebook", "literacy", "experience" and "culture" (Brown, 2020; Nyoni and Velempini, 2018; Teresa L. Mendoza and Jun P. Mariani, 2022; Alkire et al., 2019). As the number of Facebook users in Bangladesh is growing at a very high rate, all of these aspects are important to study in the context of Facebook users in Bangladesh. This will help understand the level of awareness and the consequent behavior and identify the interventions needed.

Privacy Norm in Bangladesh: Privacy related to digital devices and internet usage in Bangladesh is influenced by surveillance, cultural context, and lack of knowledge and practice (Jay et al., 2018). Mobile devices are often registered to a different person than the actual phone user (Ahmed et al., 2017b), and devices are shared among the family members (Ahmed et al., 2017c). A similar practice of device sharing is also seen in nearby nations such as India and Pakistan (Sambasivan et al., 2018). Overall, the perception of privacy differs greatly from that of any Western culture (Sambasivan et al., 2018). The differences in perceptions of privacy and device sharing practices often lead to privacy violations, resulting in negative consequences.

Facebook Privacy in Bangladesh: Facebook

privacy-related research in Bangladesh can be divided into two broad themes: (1) studying usage behavior and (2) suggesting “tips” for safe use of Facebook. In a recent survey, Rahman found that although most Facebook users in their sample understood and were welcoming to the privacy features provided by Facebook, a few of them practiced those, including changing passwords, using two-factor authentication, and checking for alerts (Rahman, 2022). The behaviour resembles a phenomenon called privacy paradox reported by Barth, and Jong (Barth and de Jong, 2017). In suggesting Tips for safe usage, Rahman and Ullah provided six privacy settings to protect information from being visible to the public and third parties (Facebook ads) (Rahaman and Ullah, 2013). Ahmed et al. suggest setting the privacy options depending on priorities, regularly checking privacy settings, thinking before accepting stranger friend requests, restricting wall posts to friends only, and blocking unnecessary or irritating users. They prioritize women Facebook users, as the majority of victims of cybercrime were women (Ahmed et al., 2017a). To deal with harassment and bullying in Facebook groups (especially against women), the group admins take different approaches, such as connecting among themselves (Sultana et al., 2020).

Facebook Initiatives: Facebook has initiated the “We Think Digital” program in the Asia Pacific region in collaboration with experts (Meta, 2022a). The core aim of the program is to make a skillful digital citizen with their open source learning modules and resources (Meta, 2022c) and knowledge-based questions (Meta, 2022b). Their web portal for Bangladesh has a well-organized learning modules, links to the privacy center of Facebook, and a few videos, however, these are not interactive (Meta, 2023).

4 APPLICATION DESIGN

In previous research to understand the perceptions of privacy and the privacy behaviors of Facebook users in Bangladesh, we conducted an online survey with 188 Facebook users in Bangladesh (*reference removed for anonymous review*). From the survey findings, it was clear that Facebook users in Bangladesh are concerned about their privacy on Facebook. However, some of them do not understand all the privacy settings properly. Moreover, those who understand the privacy settings do not use them properly. It was also found that some of the Facebook settings are very complicated, as already reported by Kshetri (Kshetri, 2011). For some users, understanding the settings just by reading the description was not helpful. We de-

rived the idea of a privacy awareness application from our survey findings.

4.1 Development of Persona

From the survey responses, we noticed different clusters of Facebook users in the context of privacy. The first group of users had an in-depth understanding of the privacy feature and were mostly adults under 42. A second group of Facebook users mainly over the age of 42, did not have a good understanding of the privacy features Facebook provides due to their unwillingness to learn the settings. However, interestingly, this group of Facebook users also communicated their concerns about hacking, mobile banking-related problems, and so on. A third group of Facebook users mainly was from the 13-18 age group who had some basic understanding of making new connections and tagging, profile locking and two-factor authentication. However, they do not know about review-tagged posts and search engine features. We developed one persona for the second and the third group of Facebook users as we believe those two groups required the privacy awareness application. We followed Nielsen’s ten-step (Nielsen, 2004) approach to develop personas. Figure 1 represents the persona of the second group.

Babu

Experience
 Age: 60 years
 Gender: Male
 Babu lives with his wife and adult son. He is very near to retirement. As Babu has no other work after office his son introduced him to Facebook to get connected with his friends and colleagues. Babu enjoys browsing his news feed, which has almost become an addiction.

Active Presence on Facebook
 Babu’s interests include - political viewpoints and current world affairs. He considers Facebook as a great medium to gain knowledge regardless of justifying authentic news. Lately, he has not focused on any real-life socialization rather he is indulging in Facebook content.

Facebook Common Feature Usage
 When Babu finds any interesting video or post regarding politics, he tries to share his opinion. He gets influenced by other people who comment. The posts being public, Babu often gets negative messages from other people whose ideology does not match his. All these unwanted behaviors make him mentally upset. Despite all these problems, he experienced a wonderful moment, when he was tagged to a colleague’s post, one of his childhood friends got connected to him and it made him really happy. His friend happened to be a cousin of his colleague.

Facebook Privacy Policy Check
 When Babu experiences unpleasant situations from random users, can not figure out how to react. He often gets triggered and sometimes reacts passively to his family members. Once his account was hacked and later was recovered logging out of all devices. Since then he has been cautious not to log in to Facebook from any other device. He is also afraid of trying anything on Facebook, except reading posts and reacting with Like, Comment, and Share.

Figure 1: Persona Babu.

4.2 Specification of Requirements

From the qualitative responses of the survey describing some of the experiences of the participants with Facebook privacy settings, especially with complicated ones such as reviewing tagged posts and setting the audience of each post (interplay with profile audience setting), we identified different scenarios that could be described to the participants with a video tutorial on a mobile application. Moreover, associating ambiguous scenarios to select the best privacy setting would make their understanding of the features complete and help them effectively use those on Facebook itself. A list of primary requirements for the proposed privacy awareness application is presented in Table 1.

Table 1: Requirements.

1 Video Tutorial	
Requirement	The application will provide a description of each Facebook privacy feature with video
Rationale	This will help users understand what the feature offers and the importance of it
Note	The video should contain description, demonstrations and example scenarios
Source	Survey response on review of tagged posts and setting of an audience for posts indicated that users do not understand how these function
2 Scenario based quiz	
Requirement	After each video the application should present example scenario asking for response from the users
Rationale	It is difficult to remember and understand the complicated features just by knowing those, this feature will help users to logically work out how the features are used in real-world scenarios
Note	Scenarios should be designed in a way that requires users to think rationally
Source	Survey response where users shared their past experiences of not effectively figuring out what settings to use

4.3 Development of Prototype

We designed a low-fidelity prototype application to help them describe different privacy features with video tutorials and scenario-based interactive quizzes. Considering the personas we developed, we tried to make the prototype as simple and intuitive as possible. The prototype was developed based on Nielsen's recommendations (Nielsen, 2004). Our prototype was designed with Figma, a widely accepted tool for prototype design, and developed in both Bangla and English to cater to different audiences. The prototype is presented in Figure 2, showing the English interface.

For simplicity, we will describe the English version of the prototype; the Bangla version works exactly the same as the English one. The key features of the prototype included - an introductory view with the general description of the application, a home page listing different Facebook features, a tutorial page on

each of the Facebook features (listed on the home page), an interactive quiz page based on each feature, and a feedback page for showing the feedback on quiz response.

Consider the user persona "Babu". When "Babu" visits the "PA App" he notices the introduction page ("PA App - Introduction E") describing the application. Clicking on the "Start" button on this page "Babu" is taken to the home page view ("PA App - Homepage E"). The home page contains the list of Facebook features; for the initial version, we listed four features of Facebook such as - 1) Passwords, 2) Friends, 3) Tagging, and 4) Audience. "Babu" can click one of the features and will be taken to the tutorial for the respective feature. For the first iteration, we developed a video tutorial for the "Audience" feature only. Therefore, as soon as "Babu" clicks the option "Audience", he will be on the "Tutorial page" ("PA App - Tutorial Page E"). In the "Tutorial page" ("PA App - Tutorial Page E"), "Babu" can watch the video tutorial for the "Audience" feature of Facebook. When "Babu" has completed the video tutorial he can click on the "Quiz" button to get to the next page. In the "Quiz" page ("PA App - Quiz Page E"), a scenario-based incident related to audience settings on Facebook is presented in the form of a quiz, and "Babu" is asked what his preferred audience for such a case. He makes his choice and clicks on the "Feedback" button to visit the ("PA App - Feedback Page E"). This page shows a message that describes what option would have been appropriate according to the scenario. The feedback also contains a description of all the options with an explanation of what would be appropriate in which scenario.

5 USABILITY EVALUATION

We presented our prototype to several Facebook users and collected their feedback to refine the prototype. The evaluation was conducted according to the Human Research Ethics protocols and consent was collected from all participants before evaluation. There were a total of 15 questions (11 closed, 4 open-ended). We used SUS (Brooke, 1995) questionnaires to collect feedback on usability. Participants were asked to complete one tutorial and the relevant quiz in the prototype and answer questions such as how easy/difficult it was to use and learn, whether they needed help, how often they would use the application, whether the prototype was helpful, and so on. They also provided feedback on the open-ended questions on the overall prototype, the challenges and improvements. Data was collected using a Google form.

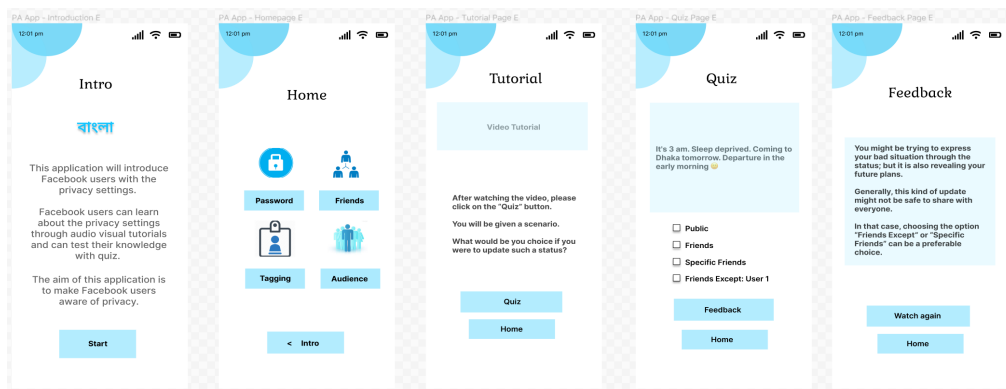


Figure 2: Overview of the Prototype.

Table 2: Evaluation Result on Prototype.

Functionality	
Feedback	Changes to be made
Personalized quiz	Integrate with the Facebook profile of the user or add an introductory quiz
More features	Add more topics of tutorial
Involving resourceful persons	Recruit UX designers and researchers
More scenarios	Add more relevant scenarios for better learning
Usability	
Radio button feedback	Add hover feature
Old fashioned	No change
Color theme	No change

Participants were recruited from personal contacts using convenience sampling. We used Thematic analysis for qualitative data.

There were eleven participants (four male, seven female) to evaluate the first version of the prototype. One participant was between 13 and 17 years old, five were between 18 and 26, four were between 27 and 42, and one was between 43 and 59. We will refer to them as P1 - P11. All participants except one, said the difficulty level was either easy or normal. In the open-ended comments participants provided welcoming responses. For example, P4 - “It was a good learn. I made the wrong choice. but later I got to know from the feedback why I should have chosen otherwise”, P9 - “Application is well needed. Though I am using FB for several years now, yet I didn’t know some of the information”, P10 - “Quite descend application. Easy for the new users of social media. Old people who recently become active in social media can use this for safety purpose”. The responses to the closed-ended questions are presented in Table 3. The five-point Likert scale was converted to a three-point Likert as there was less diversity in responses. Based on open-ended responses we derived suggestions to improve the prototype as listed in Table 2.

Functionality: When asked if they found anything challenging about the application, most were comfortable using it. In response to how we could improve the prototype, most of them said it was all right except P9 added a valuable comment - “Only if you

Table 3: System Usability Scale Report.

Would Like to Use Frequently?		Unnecessary Complex?	
Disagree	10	Disagree	10
Neutral	2	Neutral	1
Agree	9	Agree	10
Ease of Usage		Technical Person Needed?	
Disagree	10	Disagree	10
Neutral	1	Neutral	10
Agree	10	Agree	1
Functions Well Integrated		Present of Inconsistency	
Disagree	10	Disagree	10
Neutral	1	Neutral	10
Agree	10	Agree	1
Easy to Learn		Cumbersome	
Disagree	10	Disagree	10
Neutral	10	Neutral	1
Agree	11	Agree	10
Confident to Use		Needed to Learn Before Using	
Disagree	10	Disagree	9
Neutral	2	Neutral	1
Agree	9	Agree	1

can at first find out what type of post the user usually posts. Then present the post of the quiz according to the user”. Since this prototype is not integrated with the Facebook profile of the user, it is difficult to provide personalized quiz questions to each user. The prototype can be improved to either integrate the user’s Facebook profile or present an introductory quiz at the beginning to understand specific user preferences. In either case, the feature will need to be implemented with AI.

Usability: Overall, all participants seemed to be happy with the usability of the prototype as illustrated in Table 2. One participant (P5) shared not being able to interact with the radio button - “I couldn’t understand which radio button I pressed as the radio didn’t activate”. There were no radio buttons used, however, the “PA App - Quiz Page” contains check boxes. We believe the participant was referring to that. We will add a “hover” feature to let users know what they are selecting. In reviewing the usability of the prototype, P4 said “The app style is old-fashioned. Could have been more interesting and fun” and P8 said - “Maybe the color combination? I don’t know. I found it just

okay”. Since both the participants were not specific, we did not make any changes.

Improvements: Based on the feedback received in the evaluation phase with the users, we include more functional requirements to our original set of high-level requirements. An updated list is presented in Table 4. The major update is adding an introductory quiz, as suggested by P9. The quiz will assess the level of understanding of the privacy features, and based on the assessment, appropriate tutorials, and associated scenario-based quizzes will be provided to the users. We will make the introductory quiz a periodical one so that users can re-check their understandings.

Table 4: New Requirements After Usability Evaluation.

3 An introductory quiz	
Requirement	The application will contain a quiz on different privacy features
Rationale	The quiz will assess the user’s understanding of privacy features
Note	The quiz will be presented at the beginning and can be visited periodically
Source	Usability evaluation (P9)
4 Tutorial and scenario based on understanding level	
Requirement	The application will present the video tutorial and the scenarios based on the level of understanding of privacy features as assessed by the introductory quiz
Rationale	The purpose of the introductory quiz is to assess the level of understanding of the privacy features, so that users are presented with tutorials and scenarios matching their understanding
Note	This requirement will ensure that expert users are not presented with simple scenarios and vice versa
Source	Usability evaluation (P9)

6 DISCUSSION

We summarize the lessons we have learned and propose specific recommendations for different phases of the UCD process. We also suggest future directions for the development of the designed privacy awareness applications and aim to replicate the study with more diverse user groups. Figure 3 presents our recommendations for each UCD phase.

Demonstration of Concepts: From the detailed survey responses we found that one group of users indicated confidence in the privacy features; however, from some shared experiences, we found that they were not using the privacy features properly (despite saying they understood those). For example, one participant said they hesitated to share a photo of hanging out with friends late at night, as this can upset their mother. However, earlier, they said they understood how the audience setting feature “friends except” worked. This example comment indicates that the participants did not use the setting to ex-

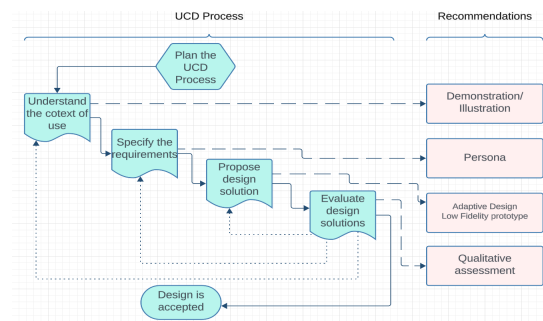


Figure 3: Recommendations for UCD.

clude someone seeing their post. This indicates that Facebook users in Bangladesh often cannot use their privacy settings properly, although they understand them. This implies the necessity of teaching the settings with example cases. Due to the complex nature of the settings, it wasn’t easy to express the survey questions with words only. As such, we included diagrams, images, and example cases. Surprisingly, some of the survey participants indicated that those were very helpful. This is another motivation behind developing a privacy awareness application that will teach the settings and help the users use rational thinking to apply those in example scenarios to prepare better for real life.

Importance of Persona: We found that according to the awareness of privacy features and their application, there are different groups of users. We found two groups of users who needed some training on understanding the privacy settings. The privacy awareness application is designed for the customized needs of these two groups of users. Personas were very helpful in understanding and empathizing with those diverse users. For example, the persona in Figure 1 was reluctant to learn new things. These unique characteristics were considered while designing the prototype. Existing literature also reported similar experiences (Kani et al., 2023).

Low-Fidelity Prototype: The usability evaluation with the low-fidelity prototype helped communicate the concept of a tutorial and scenario-based application to the users, getting feedback on the design concept, and refining the prototype with new directions that gravitated toward what the users expected. Since awareness-building applications, especially for social media usage (specifically Facebook usage in Bangla), are not a familiar concept, the prototype with sample video and quiz helped the users understand the purpose and flow of the privacy awareness application under consideration. It will be possible without the prototype. Moreover, users could navigate through the application interface on the Figma prototype, and as such, they provided critical feedback on usability,

such as colour and highlighting options. Most importantly, they provided an excellent idea of customizing the content based on users' level of understanding. This led to the addition of an introductory quiz to assess the level of knowledge of privacy features.

User-Centered Design: We presented our experience of a complete UCD process to design a privacy-awareness mobile application. From understanding the context of use to evaluating the prototype, we collaborated with the users and found that it is necessary to include them in the process as they add valuable insight. Once presented with some artifacts, such as the prototype, they were able to provide very specific feedback. Based on our experience, we also recommend including them in the development process. We suggest that incremental development approaches such as Scrum be followed.

Adaptive Application: Our preliminary research found that Facebook users in Bangladesh have different perceptions and levels of knowledge of privacy. We designed a privacy awareness mobile application for those who we identified as needing help (not understanding the privacy setting or being reluctant to learn). However, during the usability evaluation, one participant suggested customizing the application's content based on the users' understanding level. To address the suggestion, we included a quiz that will assess the user's level of understanding and present the content accordingly. In this way, the application can adapt to the users' needs. This feature request indicates that similar applications must be designed to be adaptive to user needs.

Usability Evaluation Feedback: Although we used the SUS questionnaire to obtain a quantitative measure of our design, we found that the qualitative feedback provided by the users was constructive in (1) refining the design (i.e., ambiguity with check boxes corrected by using Hoover feature) and (2) finding new requirements (i.e., suggesting to link Facebook profile or including a quiz to assess the level of understanding of the user). From this experience, we recommend that usability evaluations should not only rely on quantitative measures, but however, should be complemented with qualitative feedback.

7 CONCLUSION

Although there are millions of users of Facebook in Bangladesh, not all of them understand the features provided by Facebook and consequently can use those properly. We identified the user groups that need help understanding Facebook features. We developed a low-fidelity prototype for a privacy awareness appli-

cation, taking the diverse end user needs in mind, and collected feedback on the prototype. We reflect on our overall UCD approach to understanding the context of use, specify requirements, design a prototype, and evaluate those with the users. Based on the feedback received during evaluation, the prototype is refined to reflect user expectations more. We found that the persona to represent diverse end users and the low-fidelity prototype to communicate the design idea were very helpful. Based on the experience we propose to include representative users in developing and testing the application.

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