



A simple, non-invasive online account information
management notebook for Seniors

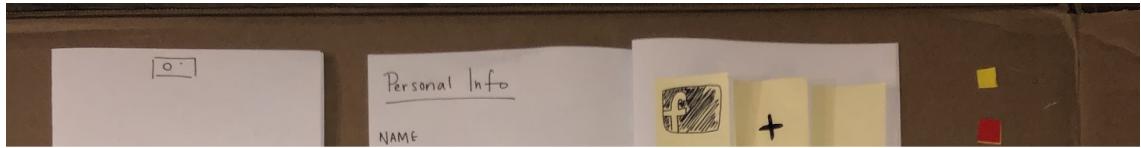
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PROBLEM AND SOLUTIONS OVERVIEW

As technology and the digital world develop, people are becoming increasingly reliant on a number of online services, which all require separate accounts to keep track of. At the same time, with so much personal information attached to these accounts, including names, addresses, financial information, and even SSN in some cases, it becomes increasingly important for people to protect their online accounts. However, we noticed that seniors are one particular demographic who often seem to neglect the security of their online presence. Thus, we sought to design a tool to help seniors be more secure online.

After further investigation, we discovered that the problem is not that seniors lack awareness of what it means to be secure online, but rather that they know what is secure and still choose insecure practices in favor of simplicity and convenience in their everyday lives. This is the main inspiration behind notE, a smart notebook where seniors can manage their accounts easily, in a familiar and intuitive form. notE retains the look and feel of a normal notebook but has a few key differences that make it an optimal solution to the problem of online account security: it only shows account login information to recognized users, gives notifications and signals based on the status of its linked accounts, and allow users to choose either receive assistance from representatives of the companies or actively take actions to recover account. After a few rounds of iteration, we believe notE is intuitive and simplistic to our users while still give them flexibility to manage their online account security.

INITIAL PAPER PROTOTYPE



There are two main components in notE. The first one is a paired pen that allows participants to write on the notebook. The pen is a pressure pen which does not contain ink. The second component is the notebook itself. The notebook contains 4 main aspects:

1. The front cover contains a camera to support facial recognition and to secure the contents of the notebook, namely in the event that it gets lost or stolen
2. An index page to efficiently search for stored account information using tabs that indicate the desired page
3. Pages/forms on which participants write down account information to store
4. Colored lights and notification screens to alert participants about any problems with an account

The main theme found in our research was simplicity. Our participants often found using new devices daunting and frustrating due to the complexity of technology. From this information we decided that our prototype should focus on being intuitive, thus we chose a design based on a notebook, which many seniors are already using on a daily basis. This was done to add a sense of familiarity and to promote ease of use. These elements of our paper prototypes help us accomplish our two main tasks.

Task 1: Storing, generating, and updating account information for seniors

Seniors can begin by pressing the “+” button at the index page to create a new page to store the information for their desired account. After pressing the “+” button, a tab comes out. Seniors then use that tab to flip to the page of the new account and fill in all the information with the paired pen and notE connects to their Facebook account. Then, a green light in the top corner and a message in the notification center on the left side indicate that the account is secure. The icon of Facebook is now generated and displayed automatically on the index page.

The yellow light on the cover means that at least one of the senior’s passwords for an account hasn’t been updated for a long time. Seniors open to the index page and see the yellow light on the icon of Facebook, so they use the designated tab to flip to the page for Facebook and read the notification on the left page, which states that the last time of updating the password was 12/7/17, so notE asks them if they want to update his password. Seniors press the checkmark to update their Facebook password. Now, the password has been changed and the notification light in the upper right corner turns green and the message shown in the notification center states that their account is now secure.

Task 2: Guiding Customers after Their Account Has Been Compromised

Seniors approach notE after entering their account information for Facebook, and see that the light on the cover is red, which means that at least one of their accounts has a security issue. They then open to the index page and find that there is a problem with their Gmail account. They then click on the tab with the Gmail logo and flip to its page using the tab that pops out. There is a red light in the top-right corner of the account page and the message in the notification center indicate that a new device logged into their account from London. The notification asks if this is the senior, to which they answer “no”. Then, notE contacts Gmail to have someone from the company contact the senior, and the message in the notification center shows that there will be someone to contact them later. Finally, the senior gets a call from the service assistant from Gmail and they are able to recover their account. Now, the light is green on the Gmail page and the message in the notification center, which means that the account is secure now.

TESTING PROCESS

Heuristic Evaluations

We first conducted two heuristic evaluations on our initial paper prototype, one in class and another after, with evaluators who are taking this class currently. In these tests, we briefly talked over our design and had them walk through each task with our prototype. The participants then provided evaluations based on Nielsen's "10 Heuristics for User Interface Design". This allowed us to quickly identify and address many glaring problems with the design before usability testing.

Usability Tests

For each test, we introduced ourselves, our project and purpose. Then we gave a brief and high-level introduction to our design. We then gave our participants scenarios to introduce our primary tasks: 1) Storing, generating, and updating account information for seniors, 2) Guiding seniors after their account has been compromised. We asked the participant to think aloud when performing the tasks. We then asked a few follow up questions. For our tests, we mainly focused on observing any frustration that may have occurred and how intuitive our design was to use.

Our first participant is 65 years old and is currently a librarian at the Odegaard library at the University of Washington. She has a neutral attitude toward modern technology. The usability test was conducted at a study room in Odegaard Library.

Our second participant is 68 years old. Her daughter works in the field of internet security which gave our participant some background about internet security and made her eager to help. The usability test was conducted in a relatively secluded area at a table in the lower level of Suzzallo library.

Our third participant is a 63-year-old retired truck driver who now studies at the University of Washington. The usability test was conducted in a Starbucks as the participant wanted open space to talk, which made him feel more comfortable in the usability test.

Protocol Development

In this first usability test, participants seemed confused about how to interact with the prototype. To address this, we began later tests by giving more introduction to how the pen is used. In addition, the participant reported that she felt anxious about making mistakes. So, in future usability tests, we emphasized that the purpose of the usability test is not to evaluate the participant but to evaluate the design, and later participants were significantly more comfortable expressing their confusion. We also found that our participant was uncomfortable with the idea of the tasks being specifically targeted towards seniors, which may have contributed to her fear of making mistakes, so we decided to make our tasks more generalized in future tests.

In the second test, we saw a significant improvement in the protocol; our participant was quite comfortable stating moments where she was confused, but seemed more comfortable using the notebook overall. However, the testing process went through significantly more quickly, so in the last test we made sure to explain in general how things work without completely revealing how to complete the given tasks with the notebook.

TESTING RESULTS

We conducted **two heuristic evaluations** and **three usability tests** to find any aspects of our design that were confusing, unintuitive, or violated any of Nielsen's heuristics for interface design.

First Heuristic Evaluation

- **Recognition Over Recall (1):** Security questions should be presented by a drop-down menu. We decided not to make this revision because a drop-down menu would make the page feel more like a tablet and would contradict with our goal of simplicity.
- **Visibility (1):** Give some confirmation after entering account information. We have changed this so that the notification on the left page and the green light in the top right corner will only appear after account information has been entered, thus serving as a confirmation that the account was connected successfully
- **Consistency (2):** Need to indicate which fields for an account are required and which are optional. We put stars to indicate required fields after seniors write down the website.
- **Consistency/Help and Documentation (2):** Not clear what the difference is between the personal info page and account page. We moved personal info page into its own page as a separate, fixed icon on the index page.
- **Visibility/Help and Documentation (3):** Not intuitively clear what the lights mean when first using notE. We set up an instruction page to introduce various aspects of using notE.
- **User Control and Freedom (3):** Need an option to take active steps if an account is compromised, rather than just having to wait for the company to call. We changed that after notE detects a risk of account compromise, in addition to the ability to call for help, there will be suggestions on actions to take in order to minimize the loss.
- **User Control and Freedom (4):** We don't handle erasing. We added a specific pen to our prototype that can be used to erase.
- **Visibility/Help and Documentation (4):** Notebook setup isn't handled, not clear how to use the notebook for the first time (how does one set up facial recognition, how do we introduce the notebook and its features?) We created a setup instruction page at the inner cover. Moved personal info page to the index page.

Second Heuristic Evaluation

- **Match System and Real World (1):** People generally read left to right so having the notifications on the left side is confusing. We believe that people generally prefer to write on the right side of the notebook, so we chose to pursue comfort of use over fixing this.
- **Visibility (1):** People don't know how strong their passwords are when they first write it in the notebook. We expanded the function of the yellow light in order to support this.
- **User Control and Freedom (3):** Does the design support undo and redo function? We made the pen support erasing. When user erases, the undo button pops out.
- **Help Users Recognize, Diagnose, and Recover from Errors (3):** What will the notebook do if people record down the wrong passwords? Will there be any notifications provided? After account info is entered, the light on the page will turn into red, which indicates that the account info is problematic. Specific messages will appear in the notification page.
- **Help and documentation (4):** Are there any instructions provided for first-time users? How will users find out instructions? We designed instructions.

First Usability Test

- **Visibility(2):** The participant didn't know what does the light on the cover and on each page stand for. We provided some "subtitle"(annotation) to make it more intuitive.
- **Help and Documentation (3):** The instruction is not intuitive and clear to the participant. We made the help section more easy to navigate by splitting it up into high-level sections, which can be clicked on to give more specific information and step-by-step guidelines
- **Match System and Real World (1):** The content "additional info" is confusing. Based on the participant's feedback, we changed it to "additional notes".
- **User Control and Freedom (2):** Participant feels hard to know when to use the pen or fingers. We add the instruction of the pen on the instruction page.
- **Consistency and Standards (1):** The HELP button should not always be there. We think that the HELP button should always be there. If the account is secure but the senior still wants to get help, this will give them more flexibility.

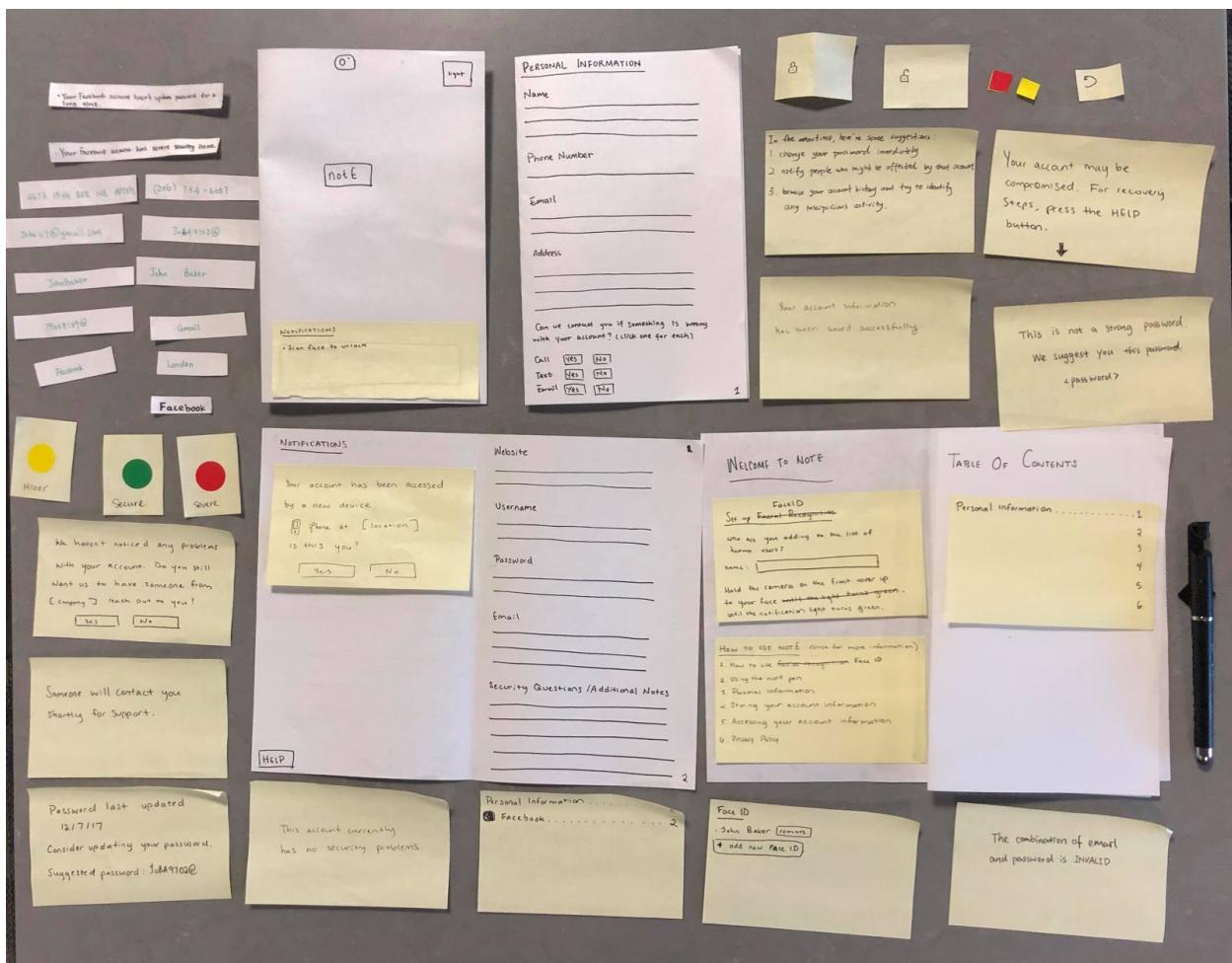
Second Usability Test

- **Aesthetic and minimalist design (3):** Participant was confused about how the index page worked. We made it look like a table of contents page with page numbers. Although they need to figure out the page number by themselves, this makes it more like a real notebook.
- **Match System and Real World (1):** Participant suggested drop-down menus for security questions which signaled our design was too similar to tablets. So instead of adding a drop-down menu, we decided to change the pages to have lines instead of text boxes, to make the design more like a traditional notebook.
- **Help and documentation (2):** Participant is confused about notebook internet connection and how it monitors the account. We added this in the instruction to explain the note.
- **Help and documentation (1):** Participant would like a notification screen in front of a notebook or would like some more immediate information on the light in the front. We added a notification center to the front cover.
- **Visibility of system status (1):** Participant would like immediate password feedback. We give immediate password feedback to participants.

Third Usability Test

- **Visibility of system status(1):** Participant wants to know how to solve the case that he forgets the password before writing them down. We do not believe that our design should support this additional service.
- **Flexibility and efficiency of use (3):** Participant wants to generate the password by themselves. We provide a suggested password for updating but seniors can write down any passwords they want.
- **Match System and Real World (1):** Participant feel confused about where to click. We changed it as "click the item below to know more information"
- **Aesthetic and minimalist design (1):** Participant wants fewer texts provided on recovering account page. We do not think we need to change this because we think it is important to provide any assistance immediately in such a situation. We don't want to let users take another extra step to choose how they want to take actions in such a situation.
- **Match System and Real World (1):** Participant feel very confused about the instruction page and index page, so we made two pages more distinctive to each other.

FINAL PAPER PROTOTYPE



As with our initial paper prototype, there are two main components in noteE: a paired pen which has the functionality of a pressure-based inkless pen on one side and an eraser on the other side, as well as the notebook itself. The notebook contains 4 main aspects:

1. The front cover contains a camera for facial recognition to secure the contents of the notebook, namely in the event that it gets lost or stolen, as well as a newly added notification center to display the most important information when first approaching the notebook, such as an instruction to scan one's face to unlock the notebook, and a dual-encoded notification displaying the current status of the accounts stored in the notebook: a colored light, as well as a textual notification to give specific details
2. A table of contents page that automatically fills in the pages of each account as information is written in the notebook
3. Pages which each contain the information and security status for a particular account and give notifications visible to inform users

4. Multiple levels of colored lights and notification screens on the cover, table of contents page, and specific account pages to clearly communicate the security status of each account

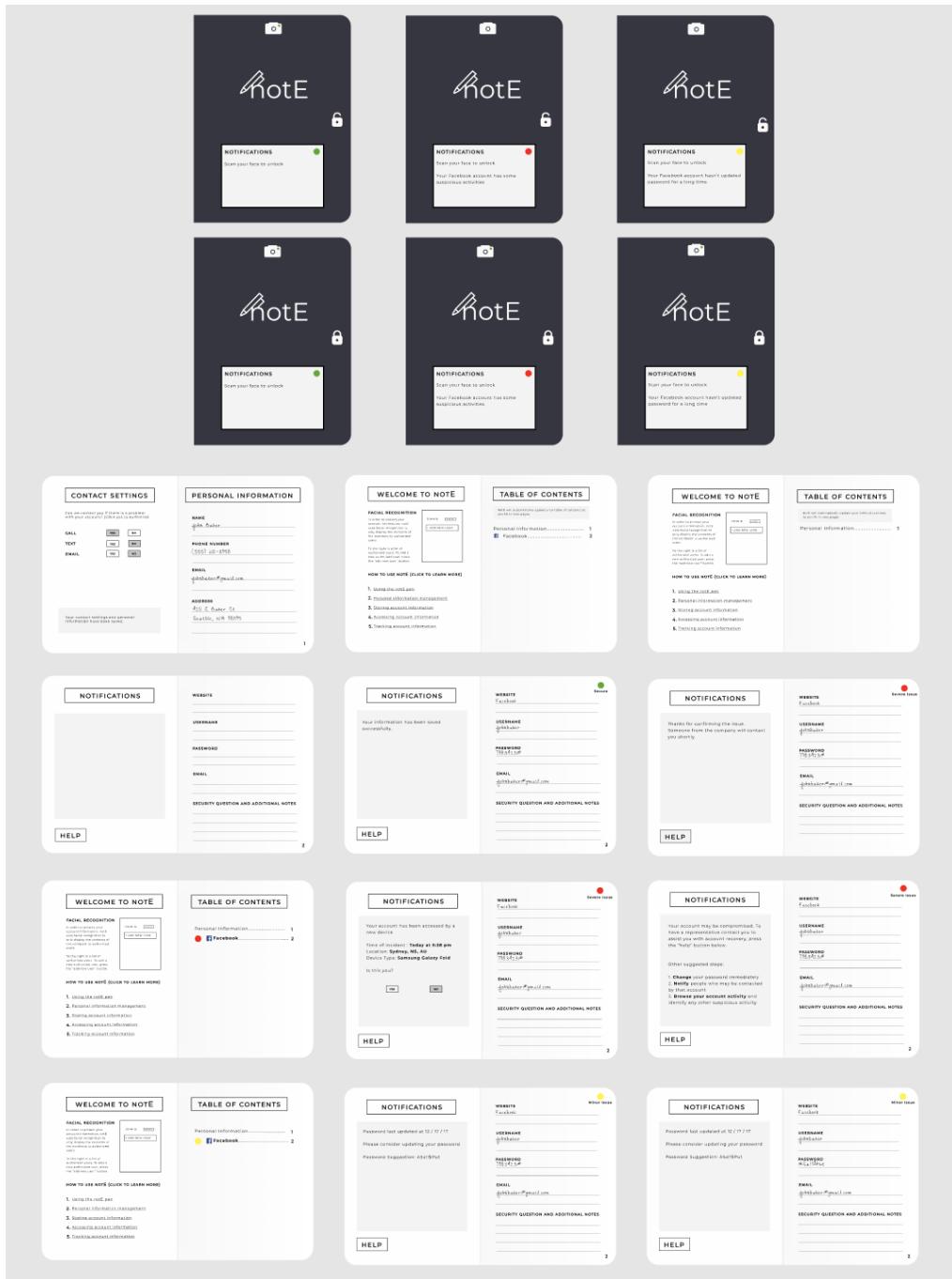
Task 1: Storing, Generating, and Updating Passwords

Firstly, our design has a facial recognition lock to ensure that only authorized users can access the account information. Following this, our design contains a table of contents page to quickly search and locate the desired accounts or the next open page. Once the next available page is located and opened, the pages can be filled with the appropriate account information, such as the name of the website, username, password, and any other additional information. Once all the information has been entered, the green notification light in the upper-right corner will appear and a notification will appear in the notification center on the left page will indicate that the account information has been saved successfully. Then, the table of contents page will automatically update to include the name and location of the new account. If the password of account should be updated, the light on the cover turns into yellow on the cover and a message is shown on the screen on the cover. The table of contents will display bold text and a yellow light next to the name of the account. The time of last upation and suggested password are presented on the notification center of the account. Once the password has been updated, the notification lights turn back to green and the notification boxes will state that there are no security issues with the account.

Task 2: Guiding Customers After Their Account Has Been Compromised

NotE actively monitors accounts for suspicious activity. On our front cover, the light indicates the status of those accounts. A green light means no security issue found, a yellow light indicates a minor issue, and a red light indicates a severe issue. Also on the cover, a notification screen gives more detail on the situation. Once an issue has been identified, the light on the front page will turn red and a brief description of the relevant account and the problem associated with it will appear in the notification box on the front cover. Then, after opening the notebook, the table of contents will display bold text and a red light next to the name of the problematic account. Once the account has been identified and the associated page opened to, the light in the upper-right corner of the account page will be red and notification screen to the left will provide more details on the issue to confirm whether the security risk is an indication of a compromised account. Then, if the account is determined to be at risk, notE will provide the option of pressing the “help” button to have a representative from the company call and give instructions to help recover the account, or taking some suggested steps to try to recover the account actively. Once the account has been recovered, the notification lights will turn green and the notification boxes will state that there are no security issues with the account.

DIGITAL MOCKUP



The main theme found throughout all of our research and testing was a desire for simplicity. From our usability tests, we found that the more our design resembles a traditional notebook, the more the participants would feel comfortable to use it, regardless of how technologically advanced the functionality was. With that in mind, our design took new form in our digital mock-up. We changed the layout of various aspects, such as the index and storage pages to that of a more traditional

notebook. We also provided additional documentation and instruction to features that were not that intuitive such as the addition of the notification box on the front cover. With this new design, we hope to better improve supporting the accomplishment of our two primary tasks.

From design critique and switching to digital tools to build up mockup, we had several changes:

- The light and the screen on the cover communicate the same ideas so we moved them close to each other. (changed from switching to digital tools)
- We edited the inside cover page to display just enough important information to quickly set up the notebook. We had initially over-corrected the issue of having too much information on the inside cover by placing everything into high-level categories, but we believe that our participants should easily find out how to add their face ID. So, we included a short description of facial recognition to provide seniors with the instructions they need to effectively set up face ID without overwhelming the participant with too many words on the front page. (changed from switching to digital tools)
- We moved the contact settings on the personal information page to the left page of the notebook. This is intended to help our participants build a mental model for using the notebook by consistently having clicking interactions on the left page and writing interactions on the right page. (learned from design critique)
- When reporting potential suspicious account activity, we included more specific information about the incident to help participants identify if this is a security problem, such as more accurate location and time of the incident. (learned from design critique)

Task 1: Storing, Generating, and Updating Passwords

Firstly, facial recognition is used to ensure secure access. Following this, our design contains an index page for quickly locate account information or the next open page available. Once participant navigates to the next available page, they can fill their information accordingly. They would write down what website the account pertains to, their username, password, etc. The notebook would also offer password suggestions on the notification page associated with the account page. Once all the information has been entered, the account would be stored and the index would update accordingly. If the password of account should be updated, the light on the cover turns into yellow on the covert and a message is shown on the screen on the cover. The table of contents will display bold text and a yellow light next to the name of the account. The time of last updation and suggested password are presented on the notification center of the account. Once the password has been updated, the notification lights turn back to green and the notification boxes will state that there are no security issues with the account.

Task 2: Guiding Customers After Their Account Has Been Compromised

Our notebook actively monitors accounts for suspicious activity. On our front cover, there is a light indicating the status of those accounts. A green light means there is no problem, a yellow light indicates a minor issue, and a red light indicates a severe issue. Also on the cover, there is a notification screen associated with the light to give more detail on the situation. Once an issue has been identified, seniors would be able to search for the potentially compromised account through the index page. In the index page, a light next to each account indicates their “problem status”. Once the account has been identified and the associated page opened to, the notification screen to the left would provide more detail on the issue. The notification page would allow seniors to choose take actions actively based on specific instructions provided or receive help from representatives of the company to recover the account.

DISCUSSION

What we learned in the iterative design process

Design should be based on our target audiences' real needs, which should be gathered from user research and usability testing (design research), rather than that what we just intuitively assume our target group's needs are. For instance, we initially thought our design would be geared towards educating seniors about online account security, but through the iterative design process, we were able to see that in reality, this was not a need at all and had the ability to change course before getting too locked into a specific design.

One goal of the iterative design is to explore an intentional and appropriate amount before beginning to refine, and we should continue the cycle of exploring and refining throughout the entire design process, rather than just exploring once and creating a finished product from that. While we were designing notE, we were encouraged to explore and iterate our design in every stage of the design process, which allowed us to constantly evaluate whether our system was as intuitive as it could be.

How it influenced our design

Consequently, our design was heavily influenced by the iterative process. For each iteration, we gathered opinions and revised our design based on them. At first, our goal was very broad and vague: some tool to help seniors with online account security. Through our design research, however, we learned that many seniors would rather continue with their everyday lives and just receive some notification and deal with a security issue if it ever happened, rather than worrying constantly about trying to avoid it. This helped us to narrow down the best way to support them; we wanted to aim for something that would encourage seniors to be generally more secure without having an intrusive lifestyle change, rather than expecting them to attain an unrealistic goal of totally caring about their account security and doing everything they can to prevent their accounts from being compromised.

How usability testing affected our tasks

Then, once we realized the real problem that we were facing was navigating the trade-off between internet security and daily simplicity, our usability tests allowed us to measure whether our solution was actually effective among our target audience. Ultimately, we found that the tasks were intuitive and necessary for our participants, but the way of accomplishing those tasks using notE was a bit more complicated. Thus, our tests did not change the essence of our tasks, but they did help us to change the way that the notebook presented itself so that our participants would have the ability to interact with it as a regular notebook, while notE did the heavy lifting of account security in a more covert way.

Why our design would have benefited from another iteration

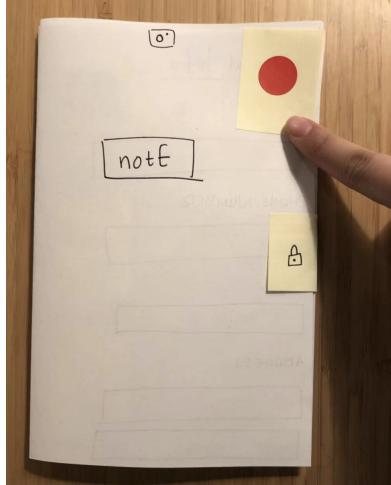
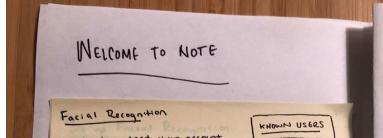
We think the design could have benefited from one more iteration. We did some revisions on our design after conducting usability tests in order to make the system more intuitive, which we believe are reasonable revisions based on the tests, but we did not have enough time to do a more comparative study. It would have been beneficial to see if our revisions did actually make a better and more intuitive solution overall.

APPENDIX

Usability Test Protocol & Script

- **Introduction:** We are students in computer science. We are in a design class and would like to test how people interact with our product.
- **Explain our purpose:** Seniors/Older people may have insecure account management habits and we would like to explore tools to make secure account management more accessible and easy for them to use. We are only to test our design rather than you. There will be no judgment. So please feel free to explore.
- **Tasks:** Our study involves us observing you performing two tasks with our product, we will ask you some follow-up questions after you finish each task.
- **Briefing:** Before we get into that lets a brief overview of the product at hand.
 - This is a smart notebook that helps you manage accounts information
 - Front cover includes facial recognition to secure to unlock your notebook
 - Pages are somewhat digital. Its higher tech than normal paper and has more functionality
 - There is a paired pen to allow you to write. This side is for writing and this side is for erasing (pointing to it).
 - Somewhat like a tablet with its writing features
 - Explain the index page:
 - Clicking on the icon would automatically flip the page for you.
 - A brief introduction on the notification page
 - We are using sticky notes and paper so if you have any confusion about how to interact with the design feel free to ask.
- **Give scenario:** This is the notebook you own and you have already set up the facial recognition.
- **First task:** we would like you to store and access your Facebook account to the notebook.
 - Observe how the participant unlocks the book.
 - Observe how the participant uses the index page.
 - Observe how the participant writes down and uses the account form.
- **Second task:** We have some security features that let you know if there is a suspicious activity with your accounts. Use the notebook to react to compromised accounts.
 - Observe how participant reacts to the change in state of the notebook(change in light color)
 - Observe how the participant uses the notebook to receive help and check up on the account.
- **Follow up questions:**
 - Did you find any aspect of the system confusing?
 - Is there any functionality you find missing or would you like to add?
 - How do you feel about this design in general?

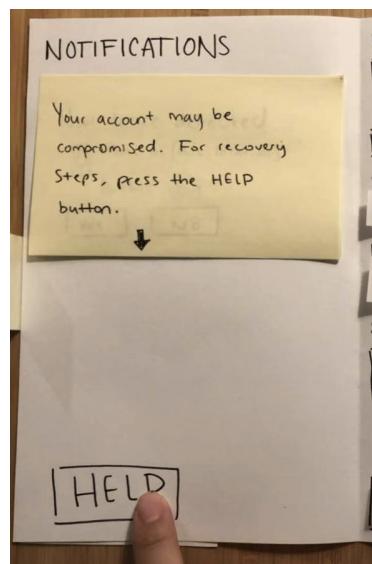
Results of Usability Test 1

| Description of the Incidents | Relevant Portion of Prototype | Revision and Explanation |
|--|--|--|
| <p>[Negative] Visibility(2)</p> <p>The participant didn't know what the light on the cover and on each page are for.</p> |  |  <p>Based on the participant's feedback, providing some "subtitle"(annotation) can make it more intuitive.</p> |
| <p>[Negative] Help and Documentation(3)</p> <p>The instruction is not intuitive and clear to the participant.</p> | |  <p>We made the help section more easy to navigate by splitting it up into high-level sections, which can be clicked on to give more specific information and</p> |

| | | step-by-step guidelines |
|--|---|---|
| [Negative] Match System and Real World(1) The content “additional info” is confusing. |  |  <p>Based on the participant's feedback, we changed it to additional notes</p> |
| [Negative] User Control and Freedom(2) “It’s hard to know when I should use the pen or my fingers.” | N/A | <p>We add the instruction of the pen on the instruction page. We also changed the protocol to give more context about the pen and how it interacts with the notebook.</p> |

[Negative]
Consistency and Standards(1)

The HELP button should not always be there



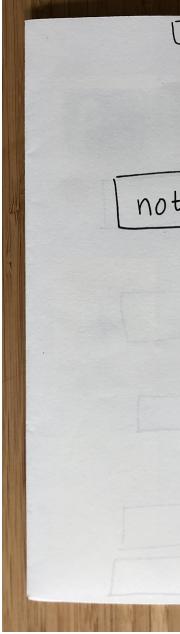
We think that the HELP button should always be there. If the account is safe but the senior still wants to get help, this will give them more flexibility.

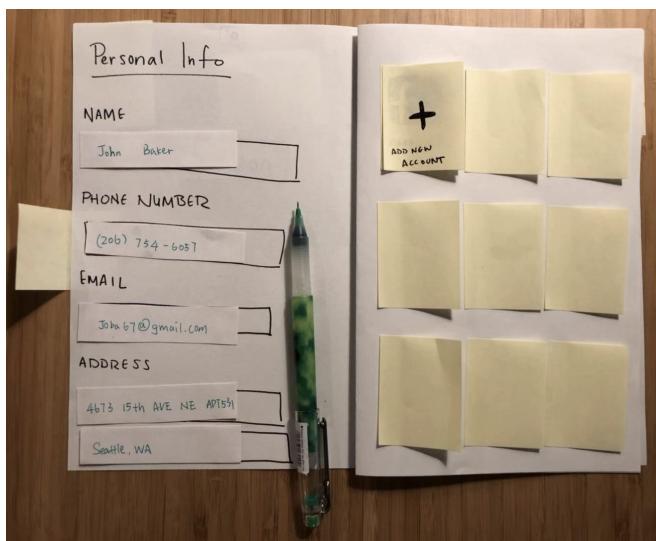
[Positive] The process of updating passwords is simple.

[Positive] “The tab seems intuitive for this physical notebook.”

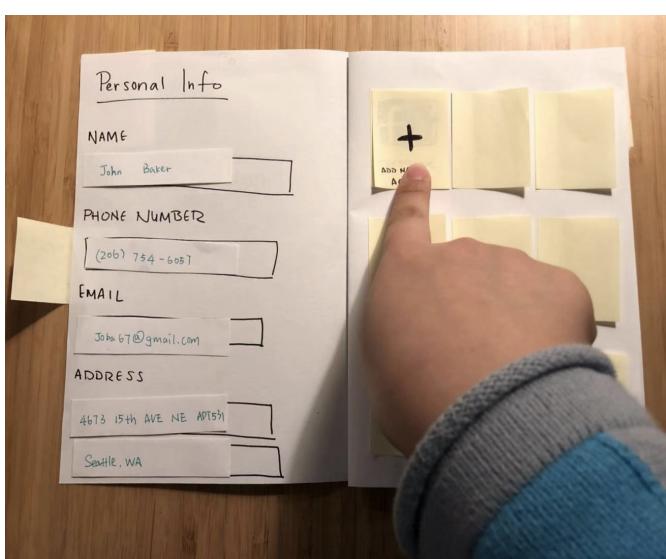
Initial Tasks Walkthrough

Task 1: Storing, Generating, and Updating Passwords

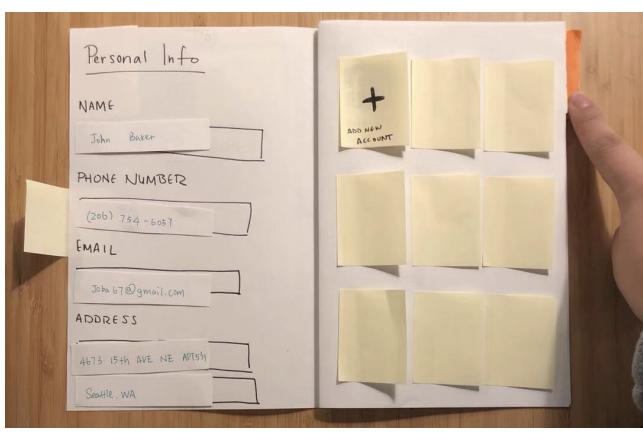
| Picture | Description |
|-----------------------------|--|
| Unlock notE |  <p>This is the front cover of the notE. There is a camera for facial recognition in the upper-middle of the front cover. The green light there is showing that all of the customer's accounts are secure now. The lock icon is to inform customers that their notE is locked.</p> |
| | <p>Now, notE is unlocked. The unlock icon is to inform customers that the notE is unlocked now.</p> |
| Storing Account Information | |



John needs to fill in his information on the left page.



John presses the "+" button at the index page to create a new page for his new account information.



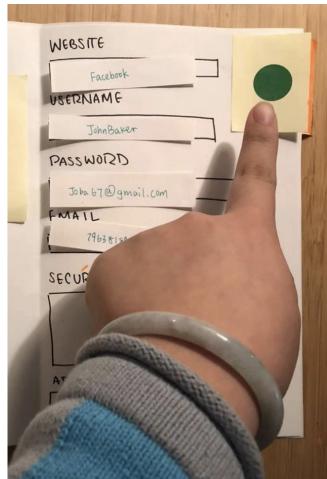
After pressing the "+" button, a tab comes out.



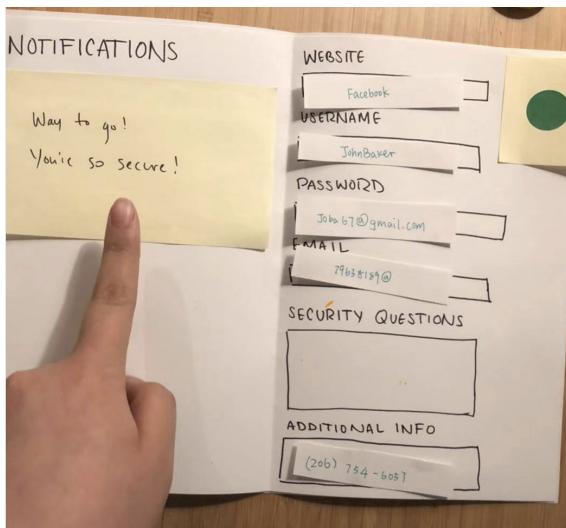
John uses that tab to flip to the page of the new account.



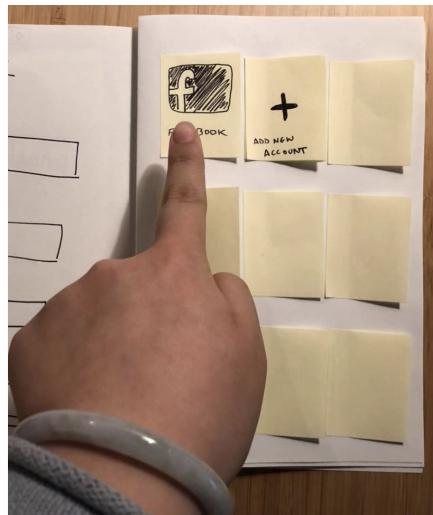
John fills in all the information with the paired pen.



Then, notE has connected to his Facebook account. The green light in the upper-right corner shows that his Facebook account is secure.

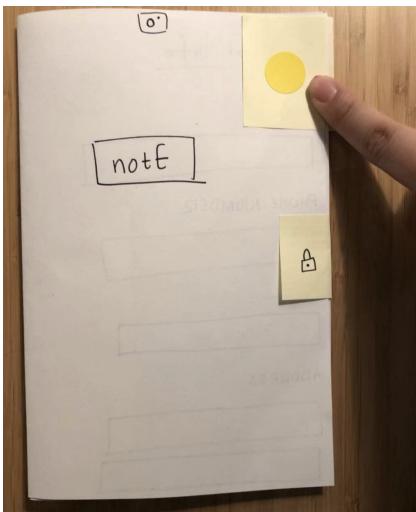


The screen at the notification center of Facebook account shows an explanation/annotation to tell him that his Facebook account is secure in words.

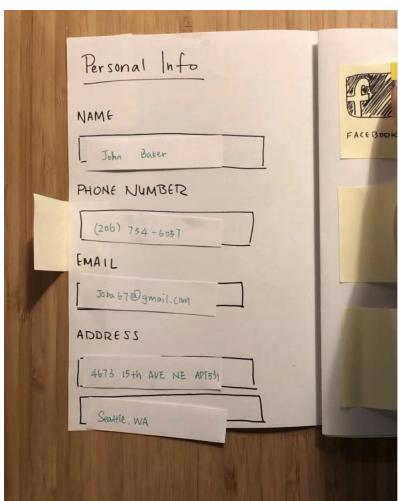


Finally, John's account information about Facebook is stored. The icon of Facebook is now shown(generated) on the index page.

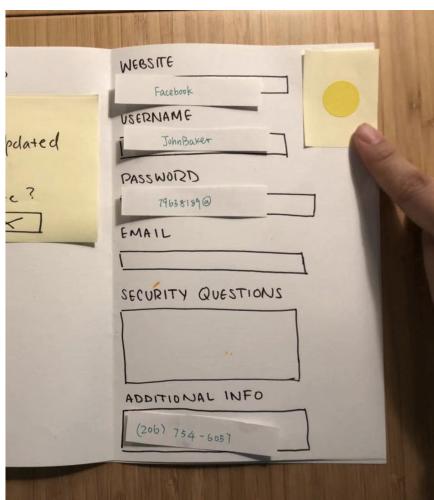
Updating and Generating Passwords for Accounts



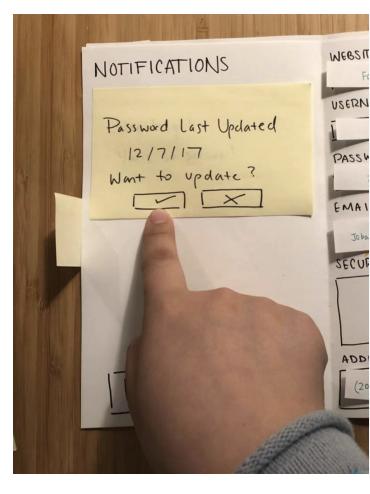
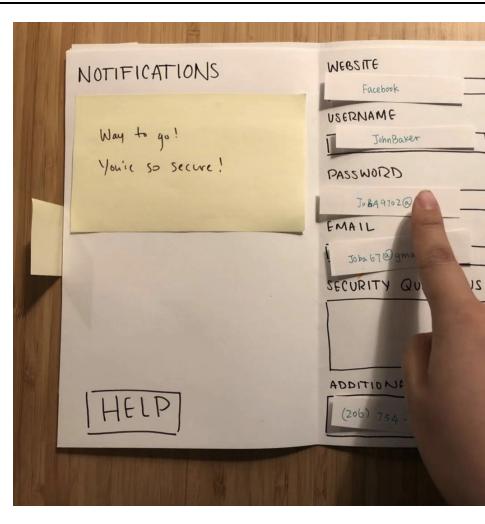
John notices that the light on his note is yellow now, which means that one of his passwords or accounts should be updated.



John opens to the index page and he finds that the yellow light is shown on the icon of Facebook. Then he knows that he should update the password for his Facebook account.

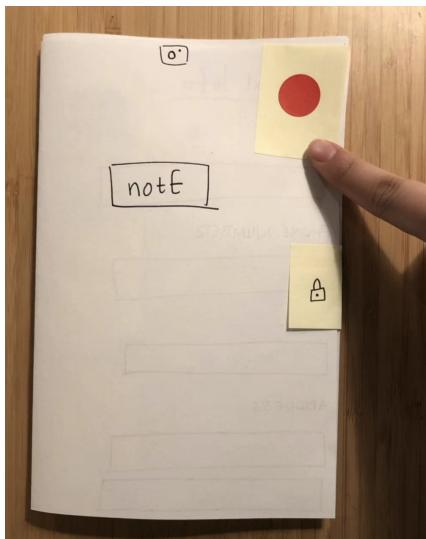


John flips to the page of Facebook, and the yellow light at the upper left corner notifies that he should update his password for his Facebook account.

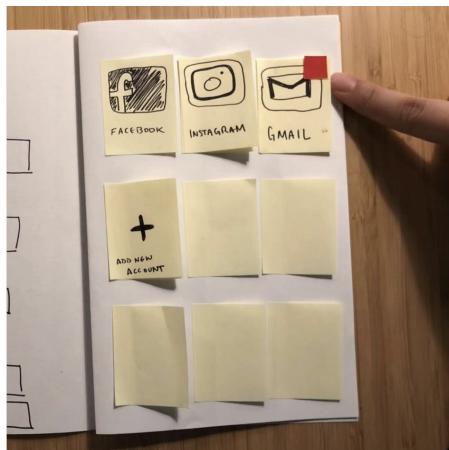
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|  | <p>John reads his notifications at the Facebook notification center, and he knows the last time he updated his password was 12/7/17, so notE asks him if he wants to update his password. He presses the checkmark to update his Facebook password.</p> |
|  | <p>Now, John's password has been changed. The green light at the upper right corner and the message shown in the notification center mean that his account is secure now.</p> |

Task 2: Guiding Customers After Their Account Has Been Compromised

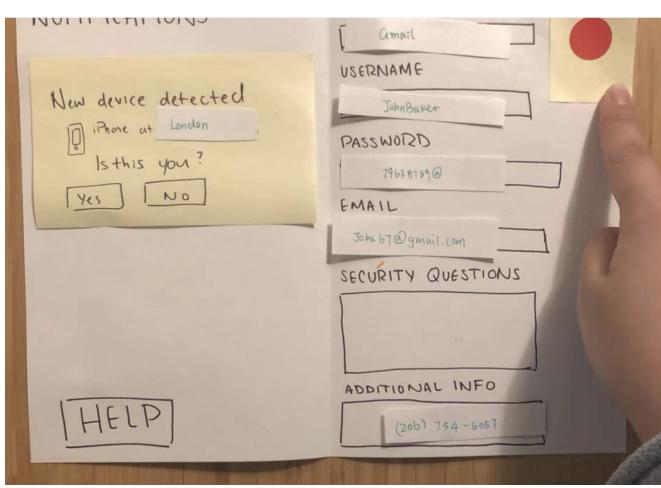
| Picture | Description |
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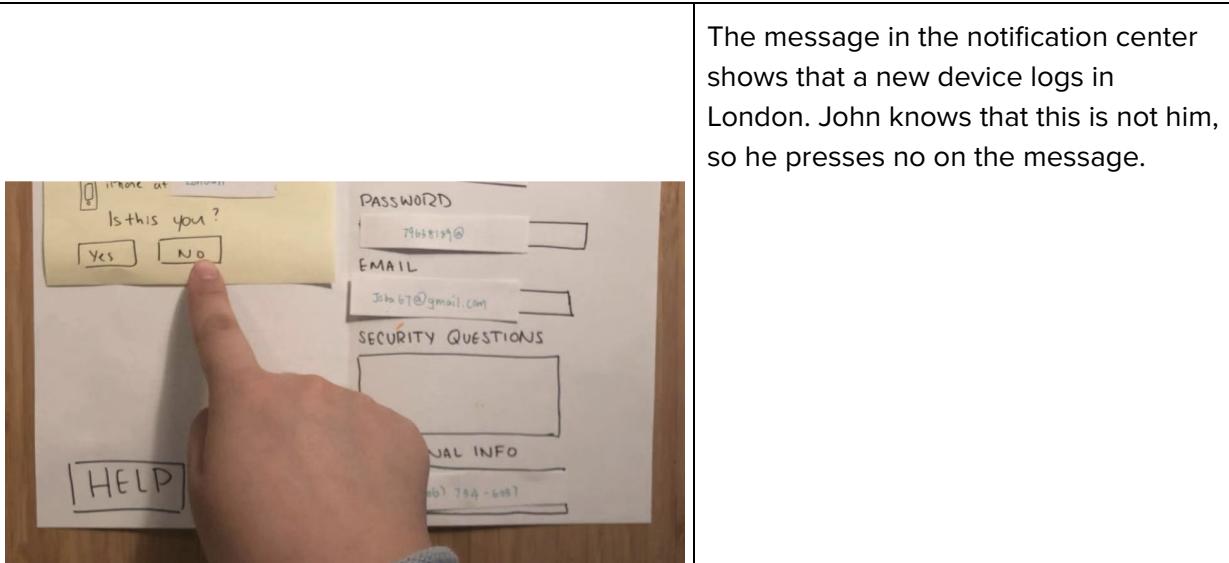
John finds that the light on his note is now red, which means that at least one of his accounts has encountered some problems.



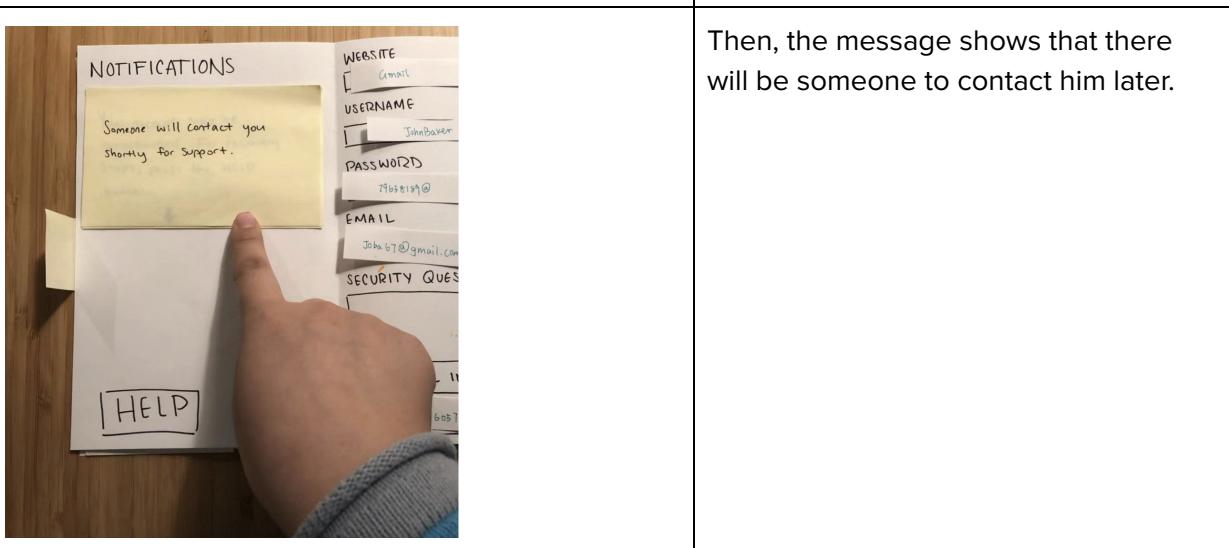
John opens to the index page and he finds that there is a problem with his Gmail account.



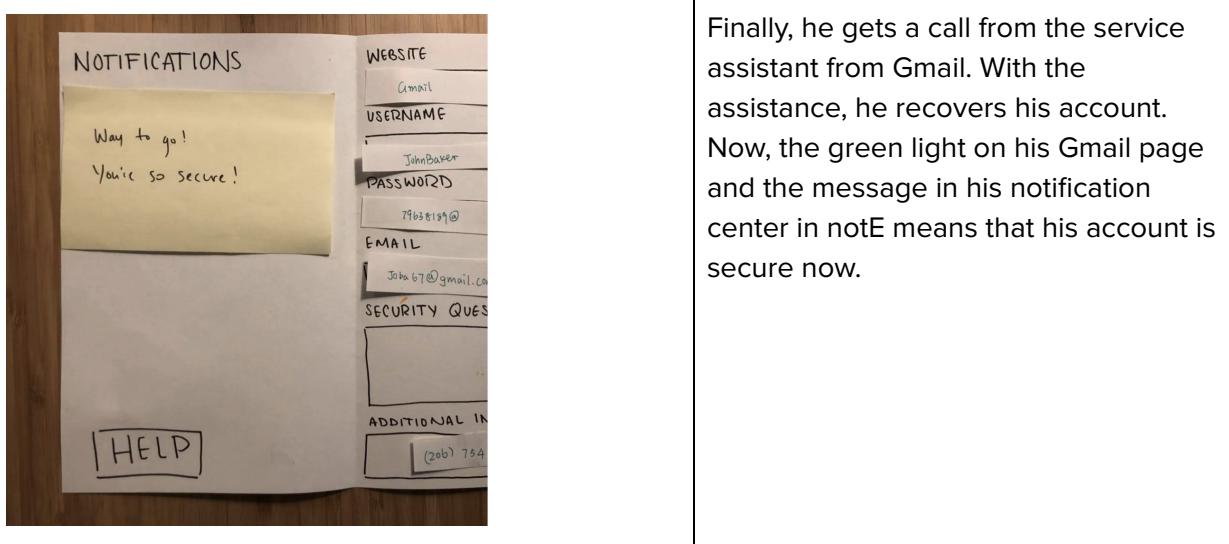
He flips to the page of Gmail. The red light there means that there are some problems with this account.



The message in the notification center shows that a new device logs in London. John knows that this is not him, so he presses no on the message.

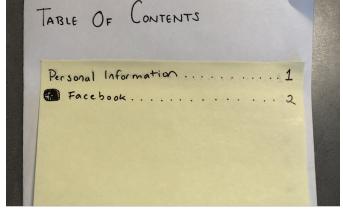


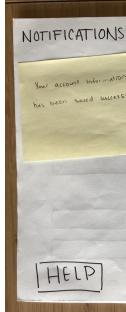
Then, the message shows that there will be someone to contact him later.

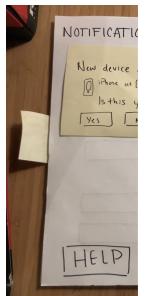


Finally, he gets a call from the service assistant from Gmail. With the assistance, he recovers his account. Now, the green light on his Gmail page and the message in his notification center in note means that his account is secure now.

Results of Usability Test 2

| Description of the Incidents | Relevant Portion of Prototype | Revision and Explanation |
|--|---|---|
| <p>[Negative] Aesthetic and minimalist design(3)</p> <p>“Tabs are somewhat complicated and a little bit confusing”</p> <p>Participant was confused about how the index page worked.</p> |  |  <p>Make it look like a table of contents page with page numbers. Although they need to figure out the page number by themselves, this makes it more like a real notebook.</p> |
| <p>[Negative] Match System and Real World(1)</p> <p>“Would it have like a drop-down menu”</p> <p>Participant suggested the idea of a drop-down menu when writing down security questions because that is what she is used to seeing on internet browsers</p> | | <p>This signalled to us that our design was too much like a tablet and not enough like a notebook, so instead of adding a drop down menu, we decided to change the pages to have lines instead of text boxes, to hopefully change the framework that our participants approach the notebook with.</p> |

| | | |
|---|--|---|
| <p>[Negative]</p> <p>Help and documentation(2)</p> <p>“How does it connect to the internet and my accounts”</p> <p>Participant is confused on how the notebook is connected to the internet and how it accesses/monitors the account</p> | | <p>Add an explanation about how this notebook works.</p> |
| <p>[Positive]</p> <p>Participant liked being given confirmation after entering account info</p> |  | |
| <p>[Negative]</p> <p>Help and documentation(1)</p> <p>Participant would like a notification screen in front of a notebook or would like some more immediate information on the light in the front.</p> |  |  <p>Added a notification center to the front cover</p> |

| | | |
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| <p>[Negative] Visibility of system status(1)</p> <p>Participant would like immediate password feedback.</p> |  |  <p>Give immediate password feedback to participants.</p> |
| <p>[Positive]</p> <p>Participant liked warning messages. Likes being notified on suspicious activity.</p> |  | |
| <p>[Positive]</p> <p>Participant liked writing things down like a normal notebook. She said it was easy.</p> |  | |

Results of Usability Test 3

| Description of the Incidents | Relevant Portion of Prototype | Revision and Explanation |
|--|---|--|
| <p>[Negative]</p> <p>Visibility of system status(1)</p> <p>“What if I don’t remember my passwords before I record them down? What shall I do to recover it?”</p> <p>Participant want to know how to solve the case that he forgets the password before writing them down.</p> |  | We do not believe that our design should support this additional service. |
| <p>[Negative]</p> <p>Flexibility and efficiency of use(3)</p> <p>“I prefer that let myself to generate a password for the update.”</p> <p>Participant wants to generate the password by themselves.</p> |  |  <p>We provide suggested password for updation but seniors can write down any passwords they want.</p> |
| <p>[Negative]</p> <p>Match System and Real World(1)</p> <p>“Click for more information? Where shall I click?” (on the instruction page)</p> <p>Participant feel confused about where to click.</p> | |  <p>Make it as “click the item below to know more”</p> |

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| | | information” |
| <p>[Negative] Aesthetic and minimalist design(1)</p> <p>“Too many texts provided for recovering an account.”</p> <p>Participant wants fewer texts provided in this page</p> |  | <p>We do not think we need to change this because we think it is important to provide any assistances immediately in such situation. We don't want to let users take another extra step to choose how they want to take actions in such a situation.</p> |
| <p>[Negative] Match System and Real World(1)</p> <p>“The instruction at the back of the front cover makes me confused...because I read from the left to right. I hope I can directly see the index rather than the instruction...”</p> <p>Participant feel very confused about the instruction page and index page.</p> |  |  <p>We make two pages more distinctive to each other.</p> |
| <p>[Positive] “I think the way to add face is very simple!”</p> | | |

[Positive] “Having color light on three sites (cover, index page, account page) is very easy for me to know which account has problems.”



Task 1: Storing, generating, and updating account information

Storing account information

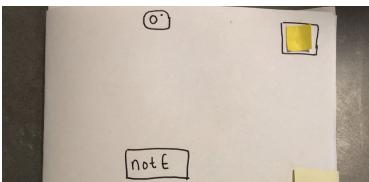
Senior can directly flip to the next available page or they can use the index page to find the next available page.



Write down account information (there will be suggested strong password)



A message will show up to notify the senior that their information is saved.

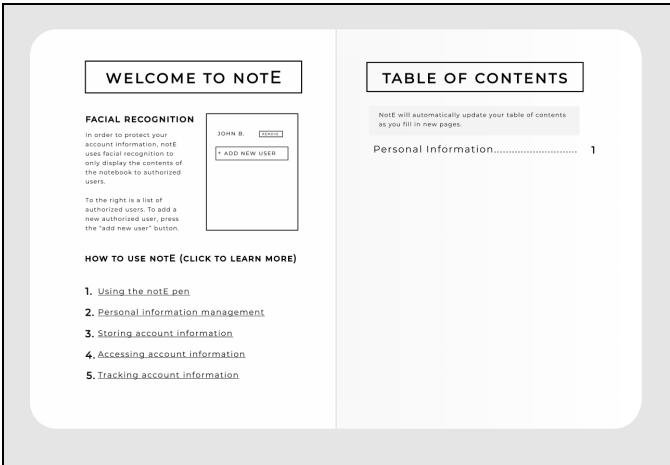
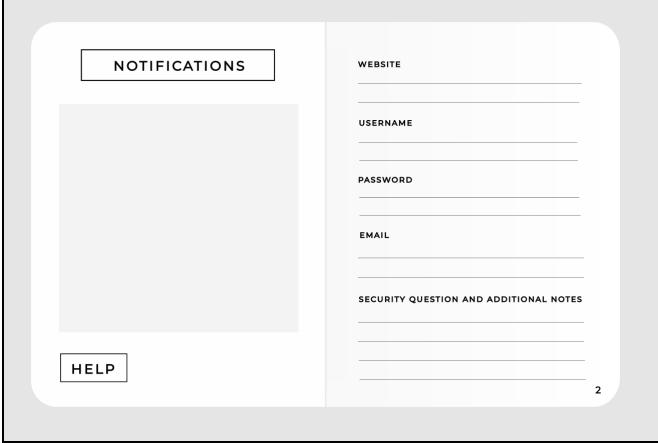
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| After the account is connected, the light on the account page turns into green. | | |
| Generating and updating account information if needed | | |
|  | | |
| If an account hasn't been updated for a long time, the screen on the front cover turns yellow and a text notification will appear at the bottom of the page. | After using facial recognition to open the notebook, senior can see that the light next to the name of the account and the name is bold. | Senior flips to the page of the account and they can see the suggested password listed in the notification center. They can either use the suggested password to update, or generate their own password. They will erase the original password and write down the new password. |

Task 2: Guiding Customers after Their Account Has Been Compromised

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|  <p>If an account has a severe security issue, the screen on the front cover turns into red and a text notification will appear at the bottom of the page.</p> | <p>Seniors open the notebook and go to the index page. The problematic account will be identified by red light and bolder font.</p> |  <p>Seniors navigate to the problematic page whose page light is red and there are notifications indicating the specific risk on the notification(left) page.</p> |
|  <p>If the senior thinks this is a problem, the message asks if the senior wants to receive any help from others. A list of suggested solutions will also be shown.</p> |   <p>The senior could either let someone contact them or take actions actively. If they choose to take action actively, they can follow our suggested solutions. If they choose to receive help from others, the officer from that company will contact and help them.</p> | |

Task Walkthrough for Digital Mockups

Task 1: Storing, generating, and updating account information

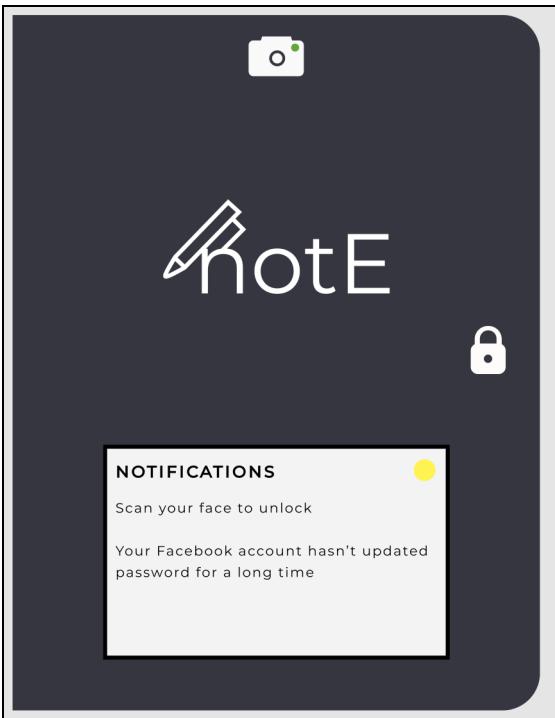
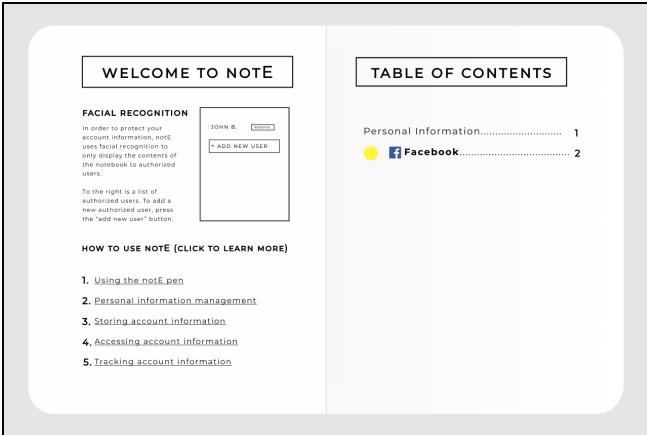
| Storing account information | |
|---|--|
| Image | Description |
|  | <p>Before filling any pages, seniors can see the the page number of “Personal Information” on the table of contents. Seniors can flip to the next available page and fill in the information for the Facebook account.</p> |
|  | <p>According to the table of contents, page 2 is the next available page. Here, seniors flip to page 2 and enter the information for the Facebook account using the paired pen.</p> |

After entering information for the new account, seniors can see a notification to tell them that the information has been saved. A green light appears indicating that the account has no security issues.

| | |
|---|--------|
| Personal Information..... f Facebook..... | 1 2 |
|---|--------|

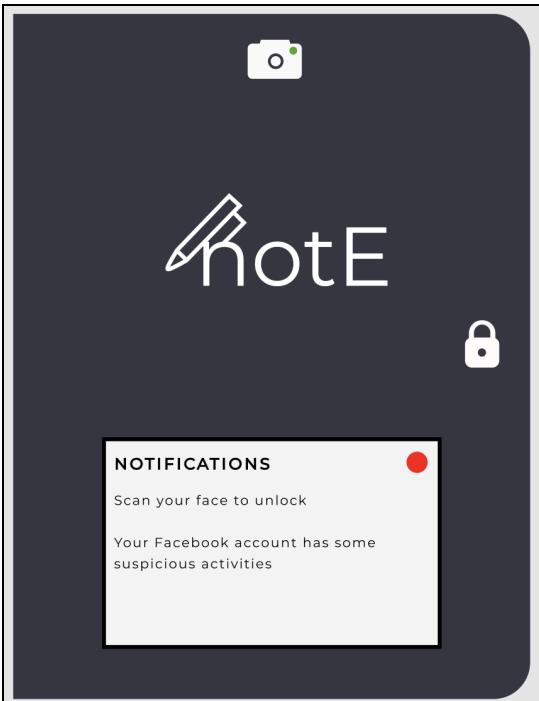
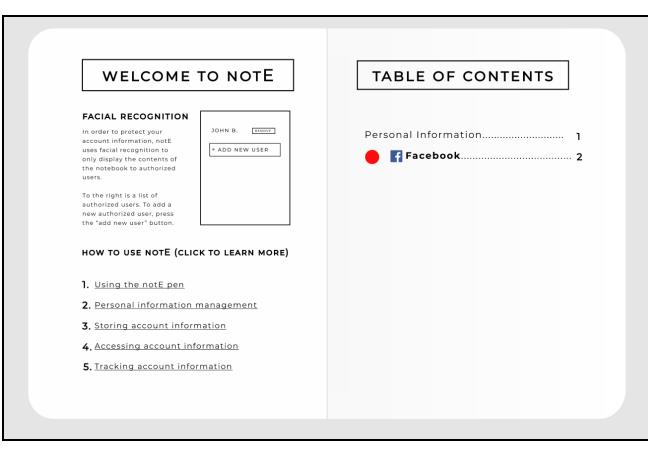
After the Facebook account is connected, the table of contents will be updated automatically. Seniors can go to the page of Facebook to access the account information by looking at the table of contents. If seniors return to the Facebook account page, a notification will display that the Facebook account has no security issue.

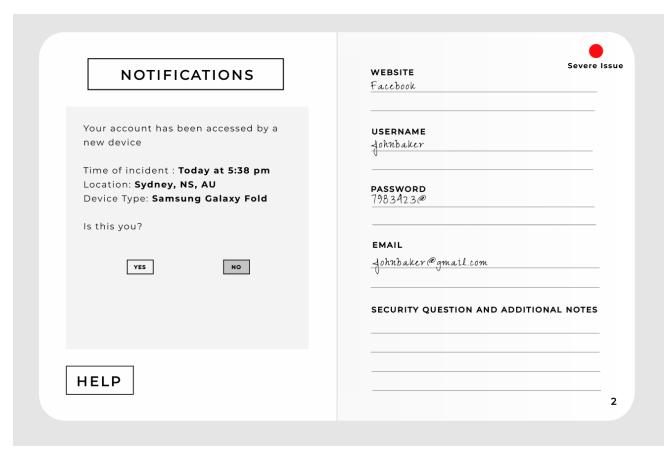
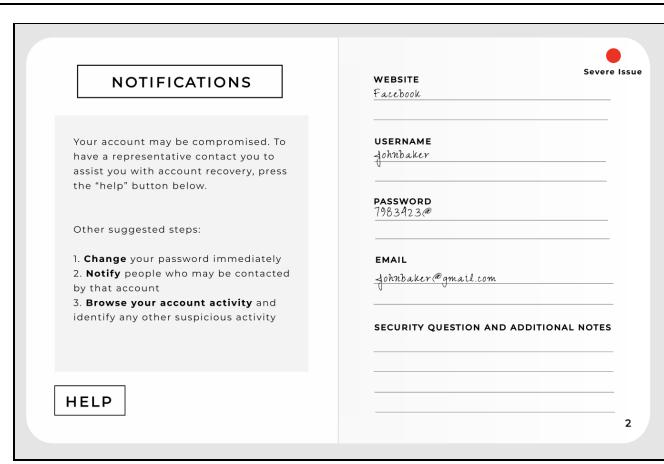
Generating and updating account information

| Image | Description |
|---|---|
|  <p>The image shows the lock screen of the notE app. At the top, there's a camera icon and the notE logo. On the right side, there's a small lock icon. A notification box appears in the center, containing the text "NOTIFICATIONS" and "Scan your face to unlock". Below that, it says "Your Facebook account hasn't updated password for a long time". A yellow circular indicator is visible next to the notification box.</p> | <p>If seniors haven't updated the password of Facebook account for a long time, the light on the front cover of the notE will turn into yellow and a text notification will appear on the screen at the bottom of the page to tell seniors that the password of Facebook should be updated.</p> |
|  <p>The image shows the "TABLE OF CONTENTS" page of the notE app. It lists "Personal Information" (1) and "Facebook" (2). The "Facebook" entry is bolded and has a yellow circular indicator next to it. Below the table of contents, there's a section titled "HOW TO USE NOTE [CLICK TO LEARN MORE]" with a numbered list from 1 to 5.</p> | <p>After using facial recognition to open the notebook, seniors will notice that the table of contents page displays a yellow light next to the name of Facebook and the name of Facebook is bold, which means the Facebook account has some minor issue.</p> |

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| | <p>After flipping to the page of the account, seniors will see that the yellow light at the corner of the page. The notification center on the left page displays a notification to tell seniors for updating the password, as well as a suggestion for a strong password.</p> |
| | <p>Seniors can use the eraser side of the pen to erase the current password. They can choose to write down the suggested password or write down their own new password.</p> |
| | <p>Once seniors update the password, the light notification returns back to green to indicate that the Facebook account is secure. The notification center shows that there Facebook account has no security issues.</p> |

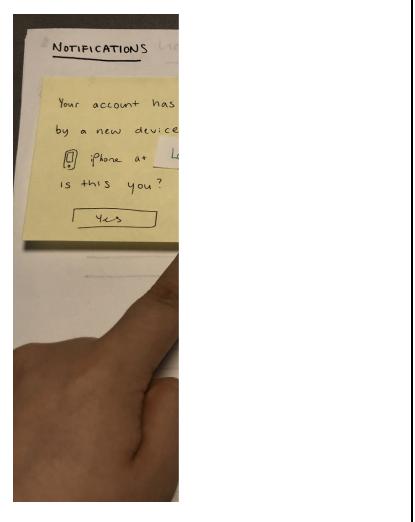
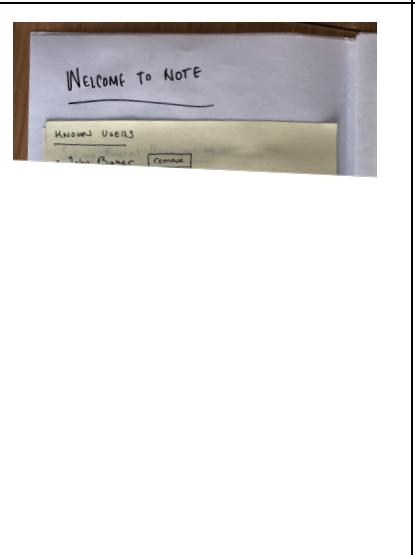
Task 2: Guiding Customers after Their Account Has Been Compromised

| Image | Description | | | | |
|--|--|---|---|---|---|
|  <p>The image shows the front cover of the notE notebook. At the top center is a small camera icon with a red dot indicating it's active. In the bottom right corner is a white padlock icon. A central rectangular area contains the word "notE" in a large, lowercase, sans-serif font. Below this is a smaller lock icon. A small rectangular box labeled "NOTIFICATIONS" is overlaid on the bottom half of the cover. It contains the text "Scan your face to unlock" and "Your Facebook account has some suspicious activities".</p> | <p>If the Facebook account has possible severe security issues, seniors will see that the screen on the front cover displays a red light and a text notification indicating that with the Facebook account has some suspicious activities.</p> | | | | |
|  <p>The image shows the open notE notebook. On the left page, under "WELCOME TO NOTE", there is a section titled "FACIAL RECOGNITION" with explanatory text and a button for "ADD NEW USER". Below this is a list of five numbered steps under "HOW TO USE NOTE (CLICK TO LEARN MORE)". On the right page, under "TABLE OF CONTENTS", there is a table:</p> <table border="0"> <tr> <td>Personal Information.....</td> <td>1</td> </tr> <tr> <td>●  Facebook.....</td> <td>2</td> </tr> </table> | Personal Information..... | 1 | ●  Facebook..... | 2 | <p>After opening the notebook, seniors will see that a red light next to the name of the Facebook account and a bolder font of Facebook on the table of contents, which indicate that the Facebook account has a possible security problem.</p> |
| Personal Information..... | 1 | | | | |
| ●  Facebook..... | 2 | | | | |

| | |
|---|---|
|  | <p>Seniors navigate to the designated page for their Facebook account. There, the light on the page is red. The notification indicates the specific risk on the notification (left) page. There, they can click on “no” to indicate that they do not recognize the login activity by this device.</p> |
|  | <p>After clicking “no”, seniors will see the options on the notification center. They can either press the “help” button to receive help from a representative from Facebook, or take more active steps to protect their account on their own.</p> |
|  | <p>After clicking the “help” button, seniors are informed that someone from Facebook will contact them shortly for additional help to recover their account.</p> |

Changes from Paper Prototype to Digital Mockups

| Paper Prototype | Digital Mockup | Rationale |
|-----------------|----------------|--|
| | | The light and the screen communicate the same ideas so we moved them close to each other. |
| | | We moved the contact settings to the left page of the notebook to uphold the consistency of using the pen on the left page as a stylus for clicking/pressing interactions, while on the right page as an actual pen with writing/erasing interactions. |

| | | |
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|  | <p>NOTIFICATIONS</p> <p>Your account has been accessed by a new device. This phone at [redacted] is this you?</p> <p>[redacted] Yes</p> | <p>We included more specific information about the potentially suspicious account activity to help participants identify if this is a security problem.</p> |
|  | <p>WELCOME TO NOTE</p> <p>UNKNOWN USERS</p> <p>[redacted] John Bunker [redacted]</p> <p>FACIAL RECOGNITION</p> <p>In order to protect your account from unauthorized access, we encourage you to use facial recognition to only display the contents of the notebook to authorized users.</p> <p>To the right is a list of authorized users. To add a new authorized user, press the "add new user" button.</p> <p>HOW TO USE NOTE (CLICK TO LEARN MORE)</p> <ol style="list-style-type: none"> 1. Using the note pen 2. Personal information management 3. Storing account information 4. Accessing account information 5. Tracking account information | <p>We don't want to let seniors actively find out how to add their face ID by clicking the instruction below. So, we included a short description of facial recognition in order to provide seniors more instruction they need effectively and make the interaction flow more clear without overwhelming the participant with too many words on the front page.</p> |

Contribution Statement

Celeste: 25%, helped write initial prototype section, wrote testing process, wrote final paper prototype, helped write digital mockup, and wrote discussion, made minor edits on the entire document

Ethan: 25 %, wrote discussion, helped write initial prototype section, helped write testing process, helped write final paper prototype, helped write digital mockup, refined discussion, tailored each tasks in different prototypes, final checked and proofread the document, helped cut the content to fit into page limit.

Bill: 25%, Helped write problem solution and overview, initial paper prototype, testing process, testing results, digital mockup, and appendix.

Augustina: 25 %, wrote initial prototype section, wrote testing process, wrote final paper prototype, wrote digital mockup, refined discussion, tailored each tasks in different prototypes, worked on Appendix, final checked and proofread the document