Human Centered Security: Group Assessment 2018-19:

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I. Introduction

Technology is ubiquitous and it has infiltrated every aspect of human life. Smartphone and computer users are growing at an exponential rate. It is often assumed that older adults watch technology with skepticism [1] but according to a 2017 report - Rise of the Social Seniors revealed it was found out that 39% of older adults use technology on a regular basis and the numbers keep on increasing. [2] According to Technology Use and Attitudes among Mid-Life and Older Americans "*Privacy and security is still an issue for older adults, but many don't take proactive steps to protect themselves online.*" [3] This is because of the fact that many of the older adults are adopting technology for the first time. Since privacy and security is a major concern, configuring security and privacy settings on a smartphone is very complex for inexperienced users and hence older adults often need assistance from young family members or tech-savvy friends whom they trust.

The primary motivation for designing this mobile application prototype is to allow old users to ask for external help from trusted remote users to configure their privacy and security settings. Our aim is to provide a usable and secure interface to our clients. Our implementation is a simple android application which identifies 2 stakeholders – a) The older adult and b) the supporting trusted user. The application has 5 complex tasks related to privacy and security settings on an Android smartphone. The older adults can request help from the supporting users for each of these tasks (push mode) [4] and the corresponding supporters send instructions on how to perform the respective task using screenshots and recommendations (implicit mode) [4]. We have followed a Non-programming route using wireframes and an Android application simulation to watch the execution of every activity in action. We believe that the mobile application prototype provides an intuitive and simple user experience for the older adults and help them to configure complex privacy and security settings with ease.

The report is divided into the following sections: II. Background and Related Work, III. Concept and Implementation, IV. Evaluation, V. Discussion, VI. Conclusion and Future Work.

II. Background and Related Work

The development of the prototype was carried out in two stages. The first stage of mobile application development is to lay out contents and functionality on a page so that user needs and navigation route between different pages of the application are found out before the actual application is designed. We employ wireframes for achieving this. The aim of a wireframe is to provide a visual understanding of a page early in a project before the creative phase gets underway. [5] Wireframes can also be used to create global and secondary navigation to ensure the terminology and structure used for the site meets user expectations. [5] The main benefits of wireframes is that it is cheap and it provides a good overview of the application design and its functionalities early in the development phase.

In the second stage, we have implemented a simulation of the Android application prototype using a free online digital design tool – Invision [6]. Invision provides tools for ideation, design, prototyping, and design management [6]. The simulation allows users to interact with our mobile prototype in the same way that users interact with an actual mobile application.

There are large numbers of mobile applications available for older adults in different categories such as Pandora [7] for music lovers, Lumosity [8] for memory improvement, WebMD [9] for providing health-related information, Goodreads [10] for the book worms etc. However mobile applications for promoting privacy and security amongst the elderly is either very rare to find or non-existent. HelpMe [1] is a similar mobile application which assists older adults in performing complex tasks on mobile devices. HelpMe is a prototype that helps older users in using demanding apps [1] such as Google Maps [11] or the Email application without any external assistance, unlike our application that helps users to get external help from trusted remote users such as their friends or family members. Additionally, our application focuses primarily on essential security and privacy tasks in comparison to HelpMe which has a mixture of different tasks. Another application is PS or Personal Secretary introduced to redesign smartphone application UIs for older adults so that they can use the applications easily on their smartphones. [12] In contrast to PS, our application follows the 10 Usability heuristics for UI design [13] so that UI redesign is not required.

III. Concept and Implementation

The aim of this application is to provide older adults with a platform to get help from the trusted contacts to perform various tasks related to privacy and security, when they are not together. This application emphasizes on the tasks that can be difficult for older adults to understand or configure while using a smartphone. The two concepts used in this application are pull and Explicit way of sending the help requests.

Pull is requesting method where older adults has set of tasks to perform and they can actively request the supporter to help them with configuring the settings. Application interface will display various tasks needed to be performed and available supporters, as shown in the figure 1, there will be an option “ask the supporter”, after clicking on that it redirects to the chat area where the supporter can share screenshots explaining the necessary steps to complete the task.

Explicit is a method where supporter can pre-configure several settings on their own devices and then can recommend these to the older adults. As shown in the figure 2, after the supporter sends the screenshot, there will be an option to see the recommendations given by the supporter.

Figure 1

Figure 2

This application is designed to work on android platform. The features used in this application do not necessarily need any technical knowledge. To simplify the login setup, there is a google button which enables the user to access the application with their google account. This reduces the complexity associated with the regular e-mail and password setup. There is a particular task in the application that helps user to setup biometric login to the device using fingerprint. Older adults can be slow while entering PIN or patterns which makes them vulnerable to the attacks like thermal or shoulder surfing. By setting up the fingerprint to unlock the screen, older adults need not input any password and this reduces the risk of any side-channel attack.

IV. Evaluation and Results

I. Study Design and Study Procedure

Goal of the experiment:

The main objective of the user study was to evaluate the usability of AssistU in configuring some of the most important privacy and security settings with external help from trusted remote users. Additionally, we also evaluated the user experience of elderly people to understand whether they felt comfortable with interacting with the application.

Hypothesis:

AssistU provides an intuitive and easy to use security tool for older adults that facilitates communication between them and trusted individuals in the context of privacy and security settings on mobile devices.

Threat Model:

An older adult user enters their pin/pattern or password to authenticate and then leave the smartphone unattended for a while. An attacker then uses a thermal camera to take thermal images of the device's touchscreen. The attacker then discovers the pin/pattern or password of the user and authenticates themselves when the device is unattended.

Dependent Variables:

The following dependent variables were found out:

- Perceived User Experience: It is defined as how satisfied older adults feel when interacting with the application's UI and completing the desired tasks.
- Cognitive Load: Cognitive load measures how mentally challenging are the specific tasks for older people to execute.
- Subjective Feedback: The feedback provided by users tells if they like/dislike the application and why or what improvements could be made.

Independent Variables:

The following independent variables were found out:

- Type of smartphone OS – our application is designed for Android only.
- User's age – The user's age group range in between 20 to 32 years of age.
- Smartphone Company – The smartphone we used for our experiment if Samsung.

Baseline Condition:

A baseline condition is a condition whose performance is already known. It is necessary to define a baseline condition so that we can compare our results with it. We define the baseline conditions as:

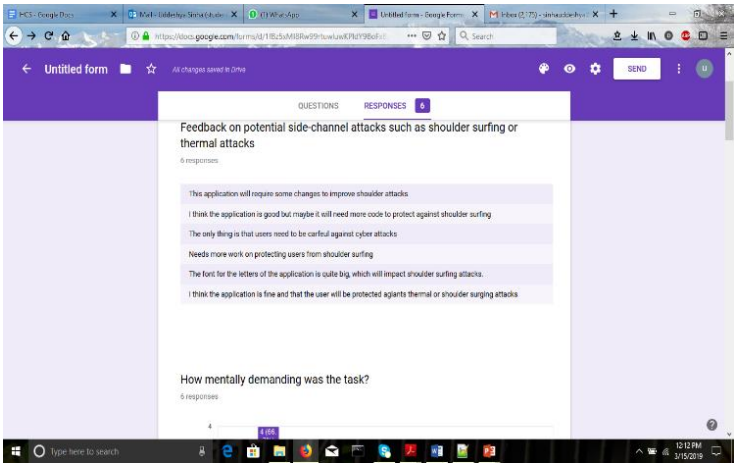
- Our implementation provides older adults with screenshots explaining every task rather than just texts.
- Older adults can ask for external help with complex tasks in contrast to HelpMe [1] which assists them in accomplish demanding tasks without external help.

Design Structure:

The design structure employed for AssistU is a within-subject design which means that all participants in the evaluation are exposed to all conditions. The conditions in our evaluation are the completion of all the six tasks presented to the users.

Design Procedure:

It is the walkthrough of the user study conducted in the evaluation of AssistU. The evaluation conducted is based on NASA TLX [14]. The NASA Task Load Index (TLX) provides multi-dimensional ratings of overall workload based on a weighted average of six subscales: mental demands, physical demands, temporal demands, performance, effort, and frustration. [14] At the beginning of the experiment, the participants were asked to read the scale definitions of the NASA Task Load Index, and it was explained how they should use the appropriate sheets. The participants were then send a google form link with a link to our prototype asking them to carry out all the 6 tasks and the follow-up questions. 6 out of 8 participants responded and we calculated the average workload of all the 6 responses. Below is a screenshot of the collected responses:



All the responses were also downloaded as a CSV file which was later used to calculate workload score.

Results: We calculated an average workload score of 16.85 among all tasks for all six of the participants. The calculations are attached in the appendix of this report.

V. Discussion

Having completed the tests through NASA TLX, we obtained an average of 16.855 as a result, which means that our application was easy to use and understandable by the users we evaluated.

What we can learn from the results is that the simpler and more useful is the user experience, the use of the tool will be easier, it is important to mention that we should not fall into a saturation of visual or textual elements so as not to saturate information and of data to users. Therefore, it is understood based on the results that the cleaner and simpler the graphical interface is as well as the visualization of the options in the application, the better the result will be. Additionally, there should not be a gap between design and security for this project the goal is to help elderly people to protect their information from cyber-attacks while helping them to have a proper and simple use of the application

The challenges we encountered was to understand how elderly people think in relation to technology so that we can develop an application based on their needs and capabilities. Regarding the part of security one of the challenges we encountered was how to design in the simplest way the way in which adult people follow the appropriate steps to stay protected.

VI. Conclusion and Future Work

Nowadays, everyone has a smartphone or at least wants one. Older people are also embracing this technical device for various purposes, but they rely on others to learn even about a minor feature. In this work, we presented an idea for designing an application that enables the older adults to get technical support from trusted individuals to configure several privacy and security settings. We also used concepts like pull requests and explicit recommendation settings for making this application easier to understand.

This application is currently limited to the android platform, in future we can try to implement on other operating systems as well. We only discussed about a single side-channel attack and there are few other to be considered. Evaluation was done by the university students, not the older people and the design was based on our assumptions. We should have consulted older people to know about the challenges they face regarding the privacy and security settings while using smartphones.

References: (IEEE)

[1]O. Duerr, M. Khamis, F. Alt and D. Buschek, "Proceedings of the CHI workshop on Designing Mobile Interactions for the Aging Populations.", Mkhamis.com, 2017. [Online]. Available: http://www.mkhamis.com/data/papers/duerr2017olderadults.pdf. [Accessed: 14- Mar- 2019].

[2]"Rise of the Social Seniors revealed", Ofcom, 2017. [Online]. Available: https://www.ofcom.org.uk/about-ofcom/latest/features-and-news/rise-social-seniors. [Accessed: 14- Mar- 2019].

[3]G. Anderson, "https://www.aarp.org/content/dam/aarp/research/surveys_statistics/technology/info-2018/atom-nov-2017-tech-module.doi.10.26419%252Fres.00210.001.pdf", Aarp.org, 2017. [Online]. Available: https://www.aarp.org/content/dam/aarp/research/surveys_statistics/technology/info-2018/atom-nov-2017-tech-module.doi.10.26419%252Fres.00210.001.pdf. [Accessed: 14- Mar- 2019].

[4]L. Mecke, M. Khamis, S. Prange, M. Hassib, F. Alt and D. Buschek, "“Outsourcing” Security: Supporting People to Support Older Adults.", Csalsa.gitlab.io, 2018. [Online]. Available: https://csalsa.gitlab.io/mobilehciageing/papers/Mecke.pdf. [Accessed: 14- Mar- 2019].

[5]"What is wireframing?", Experience UX. [Online]. Available: https://www.experienceux.co.uk/faqs/what-is-wireframing/. [Accessed: 14- Mar- 2019].

[6]"About | InVision", InVision. [Online]. Available: https://www.invisionapp.com/about/. [Accessed: 14- Mar- 2019].

[7]"Pandora", Pandora.com. [Online]. Available: https://www.pandora.com/restricted. [Accessed: 14- Mar- 2019].

[8]Lumosity.com. [Online]. Available: https://www.lumosity.com/en/. [Accessed: 14- Mar- 2019].

[9]F. Cold et al., "WebMD - Better information. Better health.", WebMD. [Online]. Available: https://www.webmd.com/. [Accessed: 14- Mar- 2019].

[10]"Goodreads", Goodreads. [Online]. Available: https://www.goodreads.com/. [Accessed: 14- Mar- 2019].

[11]"Google Maps", Google Maps. [Online]. Available: https://www.google.com/maps/. [Accessed: 14- Mar- 2019].

[12]R. Kulkarni, "PS redesign for Smartphone-using older adults - IEEE Conference Publication", Ieeexplore.ieee.org, 2016. [Online]. Available: https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=7860020. [Accessed: 14- Mar- 2019].
[13]J. Nielsen, "10 Heuristics for User Interface Design: Article by Jakob Nielsen", Nielsen Norman Group, 1994. [Online]. Available: https://www.nngroup.com/articles/ten-usability-heuristics/. [Accessed: 14- Mar- 2019].

[14]*Ntrs.nasa.gov*. [Online]. Available: https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20000021488.pdf. [Accessed: 14- Mar- 2019].

Appendix:

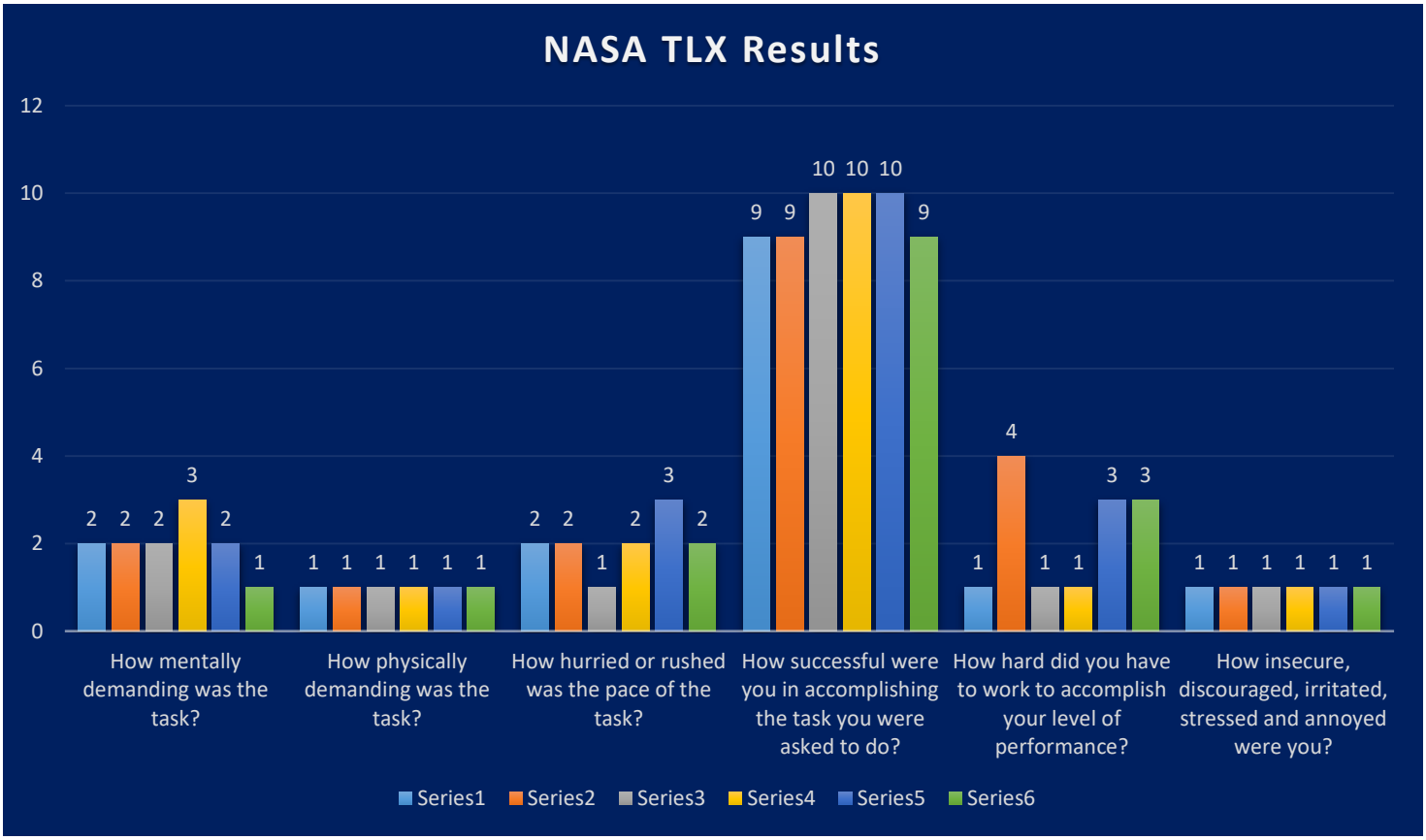


Figure: Nasa TLX Results

Participant 1

SOURCES OF WORKLOAD TALLY SHEET		
Scale Title	Tally	Weight
MENTAL DEMAND	||	2
PHYSICAL DEMAND	|	1
TEMPORAL DEMAND	||	2
PERFORMANCE	|||||||||	9
EFFORT	|	1
FRUSTRATION	|	1

Figure: Participant 1 Tally Sheet Results

Participant 1

WEIGHTED RATING WORKSHEET			
Scale Title	Weight	Raw Rating	Adjusted Rating (Weight x Raw)
MENTAL DEMAND	2	20	60
PHYSICAL DEMAND	1	10	10
TEMPORAL DEMAND	2	20	40
PERFORMANCE	9	20 (Because high performance is desired)	81
EFFORT	1	10	10
FRUSTRATION	1	10	10
			14.2

Figure: Participant 1 Weighted Rating Results

Participant 2

SOURCES OF WORKLOAD TALLY SHEET		
Scale Title	Tally	Weight
MENTAL DEMAND	||	2
PHYSICAL DEMAND	|	1
TEMPORAL DEMAND	||	2
PERFORMANCE	|||||||||	9
EFFORT	||||	4
FRUSTRATION	|	1

Figure: Participant 2 Tally Sheet Results

Participant 2

WEIGHTED RATING WORKSHEET			
Scale Title	Weight	Raw Rating	Adjusted Rating (Weight x Raw)
MENTAL DEMAND	2	20	60
PHYSICAL DEMAND	1	10	10
TEMPORAL DEMAND	2	20	40
PERFORMANCE	9	20 (Because high performance is desired)	81
EFFORT	4	40	160
FRUSTRATION	1	10	10
			22.56

Figure: Participant 2 Weighted Rating Results

Participant 3

SOURCES OF WORKLOAD TALLY SHEET		
Scale Title	Tally	Weight
MENTAL DEMAND	||	2
PHYSICAL DEMAND	|	1
TEMPORAL DEMAND	||	2
PERFORMANCE	||||||||||	10
EFFORT	|	1
FRUSTRATION	|	1

Figure: Participant 3 Tally Sheet Results

Participant 3

WEIGHTED RATING WORKSHEET			
Scale Title	Weight	Raw Rating	Adjusted Rating (Weight x Raw)
MENTAL DEMAND	2	20	40
PHYSICAL DEMAND	1	10	10
TEMPORAL DEMAND	2	20	40
PERFORMANCE	10	10 (Because high performance is desired)	100
EFFORT	1	10	10
FRUSTRATION	1	10	10
			13.124

Figure: Participant 3 Weighted Rating Results

Participant 4

SOURCES OF WORKLOAD TALLY SHEET		
Scale Title	Tally	Weight
MENTAL DEMAND	||	2
PHYSICAL DEMAND	|	1
TEMPORAL DEMAND	|||	3
PERFORMANCE	||||||||||	10
EFFORT	|||	3
FRUSTRATION	|	1

Figure: Participant 4 Tally Sheet Results

Participant 4

WEIGHTED RATING WORKSHEET			
Scale Title	Weight	Raw Rating	Adjusted Rating (Weight x Raw)
MENTAL DEMAND	2	20	40
PHYSICAL DEMAND	1	10	10
TEMPORAL DEMAND	3	20	60
PERFORMANCE	10	10 (Because high performance is desired)	100
EFFORT	3	30	30
FRUSTRATION	1	10	10
			15.625

Figure: Participant 4 Weighted Rating Results

Participant 5

SOURCES OF WORKLOAD TALLY SHEET		
Scale Title	Tally	Weight
MENTAL DEMAND	|	1
PHYSICAL DEMAND	|	1
TEMPORAL DEMAND	|||	3
PERFORMANCE	|||||||||	9
EFFORT	|||	3
FRUSTRATION	|	1

Figure: Participant 5 Tally Sheet Results

Participant 5

WEIGHTED RATING WORKSHEET			
Scale Title	Weight	Raw Rating	Adjusted Rating (Weight x Raw)
MENTAL DEMAND	1	10	10
PHYSICAL DEMAND	1	10	10
TEMPORAL DEMAND	3	30	90
PERFORMANCE	9	20 (Because high performance is desired)	180
EFFORT	3	30	90
FRUSTRATION	1	10	10
			24.373

Figure: Participant 5 Weighted Rating Results

Participant 6

SOURCES OF WORKLOAD TALLY SHEET		
Scale Title	Tally	Weight
MENTAL DEMAND	||	2
PHYSICAL DEMAND	|	1
TEMPORAL DEMAND	|	1
PERFORMANCE	||||||||||	10
EFFORT	|	1
FRUSTRATION	|	1

Figure: Participant 6 Tally Sheet Results

Participant 6

WEIGHTED RATING WORKSHEET			
Scale Title	Weight	Raw Rating	Adjusted Rating (Weight x Raw)
MENTAL DEMAND	2	20	40
PHYSICAL DEMAND	1	10	10
TEMPORAL DEMAND	1	10	10
PERFORMANCE	10	10 (Because high performance is desired)	100
EFFORT	1	10	10
FRUSTRATION	1	10	10
			11.25

Figure: Participant 6 Weighted Rating Results