HelpMe: Assisting Older Adults in Performing Tasks on Mobile Devices

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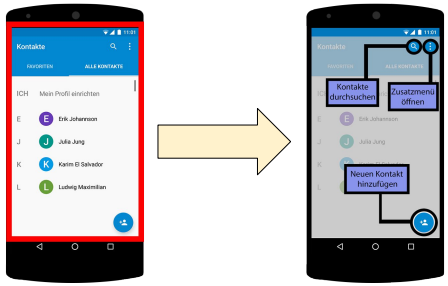

Figure 1: We introduce and evaluate *HelpMe*, a prototype system that assists older adult users in using smartphones without external assistance. This is done either by detecting certain behaviors or by manual request.

Abstract
Although mobile devices are becoming more ubiquitous, older adults have trouble catching up with the dynamics of technological innovation in smartphones. Most custom solutions for them rely on a proprietary UI with an extenuated number of interaction possibilities. While these solutions do help with basic tasks such as calling the right person, many of the benefits of having a smartphone are clearly dislodged. We introduce and evaluate a prototype, *HelpMe*, for older adult users who want to use more demanding Apps without external assistance. Through a prestudy we uncovered a set of behaviors that imply that the user needs assistance. By detecting these behaviors or by manual request, HelpMe overlays information that explain to the user what can be done on the current screen and what the different UI symbols resemble. We evaluated HelpMe in a subsequent study where we collected feedback and measured the workload. Our findings show that older adult users would benefit from HelpMe, and that it reduces the perceived workload.

ACM Classification Keywords
H.5.m [Information interfaces and presentation (e.g., HCI)]

Introduction
Mobile devices are increasingly becoming ubiquitous; when walking down a street, entering the metro or a bus, it is noticeable that a large percentage of people are interacting

with a digital world on a touchscreen. A common preconception is that older adults watch this trend with skepticism and denounce all forms of mobile communication. While this may be true for some, many are nonetheless accepting the adoption of technology [12, 14]. However, elderly users are accustomed to receiving a manual along with a technological product and could see the smartphone as a glaring challenge. On a device that receives regular updates and has access to hundreds of thousands of apps [1], a printed manual is outdated before the first shipment. Relying on family members or friends [4, 7, 9, 10] that have the time and patience to go over simple use cases can be tedious.

Some manufactures develop smartphones and Android launchers that aim to simplify the complex workings of smartphones for older adults (e.g., Power Tel m9000 [8], Doro Liberto 825 [2], and Eezyphone [3]). These solutions simplify the process, but also remake the entire smartphone experience and put the user in a separate scope of smartphone users that are oblivious to the rapid pace of change and increasing possibilities a smartphone has to offer. While these solutions focus on many concepts of the Gerontechnology research (e.g., Strengers' guidelines [13]), they greatly limit the smartphone features. Instead of implementing special applications for older adults, we focus on augmenting existing applications by a layer of explanation. Rather than excluding older adults from technological advancements, the idea is to assist them when necessary.

The contribution of this work is threefold: (1) We report on an exploratory study, in which we observed issues faced by users of age 60+ when interacting with daily applications on an Android device. Second, we introduce the concept and implementation of a prototype, HelpMe that, based on the issues detected in the previous study, guides the user through smartphone usage. Third, we report on a subsequent study where we evaluated HelpMe with a different set of older adult users, and found that it reduces the workload associated with daily smartphone tasks.

Prestudy and Concept Development

The aim of the preliminary study was to understand what kind of problems older adults face when using basic applications. Aiming to see where typical issues arise while using regular applications that many smartphone users interact with on a daily bases, we asked 5 participants with an average age of 66, who own a smartphone or a tablet, to participate in the study. Android users (4 participants) received a Nexus 5 during the study, while iOS users (1 participant) received an iPhone 6S Plus. The studies took place at their homes to ensure comfort and reduce stress. The study was video recorded for post-hoc analysis.

Participants were asked to sign a consent form to use the data collected on paper and video. The experimenter explained the study, noting that these were not applications created for the study but rather from the manufactures and asked for their honest feedback on what the biggest issues are. Each task was explained to the participant in the form of a user story. After the participant had performed each task, he/she was asked to fill in a NASA TLX questionnaire to rate the perceived workload. This was repeated for each of the following tasks: (1) Call a specific contact from the application Phone, (2) Write an E-Mail using Mail, (3) Delete a contact from the Contacts application, (4) Get directions from the current location to a particular popular square in downtown using Google Maps, (5) Find the phone number of a taxi cab service using Google Search.

Findings

The mean NASA TLX score of calling (M=11.67, SD=4.37) and using the Browser (M=23.33, SD=16.33) resulted in

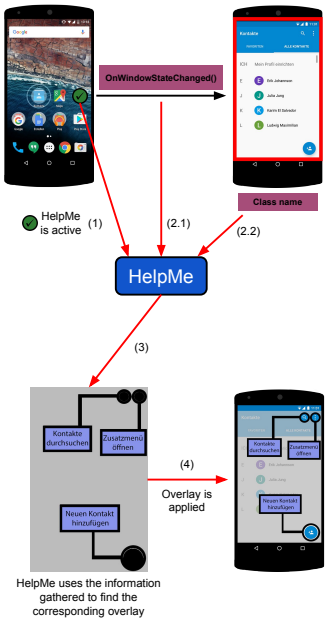

Figure 2: HelpMe assists older adults by overlaying information that explains what can be done on the current screen and what different UI symbols resemble. When HelpMe is active, the green checkmark icon is shown (1). While opening an application our system receives an accessibility event (2.1) and the new window's class name (2.2). HelpMe then determines the overlay (3) and applies it either on demand or by detecting behaviors that we found to indicate that the users needs assistance (4).

the least amount of perceived workload. Deleting a contact (M=30.83, SD=12.41), writing an E-Mail (M=29.17, SD=11.44), and using Google Maps (M=26.7, SD=14.71), resulted in the highest perceived workloads.

The most apparent issues were identifying what certain icons resemble, like the abstract paper airplane symbol in GMail for sending an email. Additionally, participants found it challenging to understand the navigation drawer concept in Google Maps, where a menu is shown by swiping from the left side towards the center. Participants also had difficulty finding the options menu for deleting a contact.

A common practice when confused was to stare at the screen for several seconds without interaction. A prominent error handling attempt was trying to reset the app by closing and reopening it within a few seconds. These issues where verbally discussed between the experimenter and the participants.

Implications from the PreStudy

We concluded that the lack of interaction for a certain time, as well as closing and reopening the app are plausible indicators that the user is unsure what to do. Hence our system should detect: (1) Closing and reopening an app within 3 seconds, and (2) Being idle for 10 or more seconds.

Based on the observations, we focused on explaining several settings and symbols. We concluded that our system should support the following: (1) All UI Icons should be explained, (2) All interaction possibilities should be explained including screen navigation (e.g., the navigation drawer).

Implementation

The system HelpMe was implemented for the main study. It utilizes an Android Accessibility Service to determine when to display an overlay that describes all UI Buttons and action widgets of the current view. Figure 2 explains the basic implementation of the system. We determined that all of the major issues we discovered in our pre-study could be simulated in Contacts and Google Maps, these were the two applications that overlays were created for. If a user does not interact with the display for 10 seconds or they exit and reenter the application within 3 seconds a red question mark icon appears on screen. Once pressed the red question mark turns into a green checkmark icon and shows the overlay. Pressing the green checkmark or tapping anywhere on the screen dismisses the overlay.

Evaluation

Using the information we gathered in our pre-study we wanted to examine if a simple hint screen could help the elderly understand unknown icons or interaction sequences without the help of a human instructor.

Nine participants with average age 72 partcipated. Two participants own an iPhone, while the others own an Android device. Three participants use their smartphone several times a day, two use it once a day, three said a couple of times a week and one said less than once a week.

The participants were asked to sign a consent form to use the data collected on paper and video. The experimenter explained the basic concept of the system and how to interact with it. Each task was explained to the participant in the form of a user story. They received a Nexus 5 device that had HelpMe installed. Participants were asked to fill in a NASA TLX questionnaire after performing each task. We also logged the time it took each participant to perform each task. We concluded with a semi-structured interview.

Results

Figure 3 depicts an overview of the mean NASA TLX scores collected from the main study for all five main study tasks.

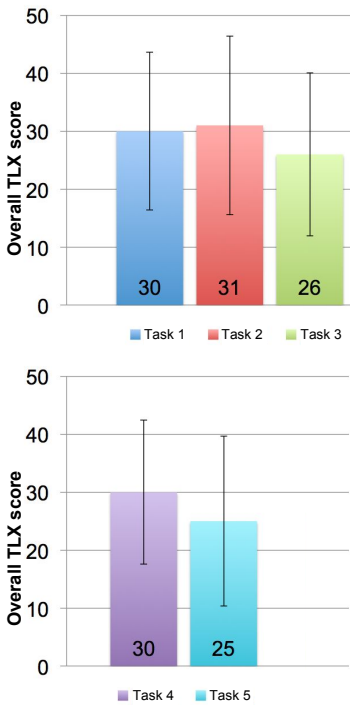

Figure 3: The figure shows the overall TLX scores of the different tasks of the main study. Tasks 3 and 5 are associated with lower TLX scores when HelpMe is employed compared to the prestudy where they resulted in scores of 30 and 35 respectively.

Editing a contact (Task 1) resulted in the second highest mean time recorded (M=146.44, SD=74.07) and an above average NASA TLX score (M=30.02, SD=13.56), 7 out of 9 used HelpMe. **Adding a new contact** (Task 2) took the longest time to complete (M=156.88, SD=54.19). This also lead to an above average NASA TLX score (M=30.63, SD=15.4). 7 out of 9 participants used HelpMe, mainly to find the floating action button to add a new contact. **Using Google Maps** (Task 3) resulted in lower NASA TLX score (M=26.22, SD=14.12) the time spent on the task was rather high (M=104.55, SD=80.74). The mean NASA TLX score in the prestudy was ≈ 30 when trying to use Google Maps to navigate, suggesting an improvement with the use of HelpMe which 6 out of 9 people relied on. **Changing the view in Google Maps** (Task 4) resulted in the fastest time recorded (M=66.78, SD=19.69) and a rather high NASA TLX score (M=30.29, SD=12.46). All participants used HelpMe to find the navigation drawer in Google Maps, where the view can be changed to satellite. **Deleting a contact** (Task 5) which resulted in a high mean NASA TLX score of ≈ 35 in the prestudy was noticeably reduced with the use of HelpMe (M=25.22, SD=14.66). The task was also completed rather quickly (M=87.55, SD=33.44) and HelpMe was used 7 out of 9 times.

Many participants relied on HelpMe to assist them. Five used it in all tasks, and stated they would want to use a form of digital assistant for all of their programs. Overall the system was used in 80% of the tasks. When asked about the specific help they received from HelpMe, three said they thought it was somewhat helpful, three said they thought it was rather helpful, and three thought it was very helpful.

Discussion

Three users have had their smartphone for over two years. They can be seen as experienced users and use there phones daily for all kinds of tasks. The error handling attempt of closing and reopening the app was not seen in the main study because only experienced smartphone users attempted the trial-and-error approach and they seem to know that closing and reopening an app would not help them. These users also regularly rejected the use of HelpMe even when the icon appeared. Inexperienced users, on the other hand, anticipated for the HelpMe question mark icon to appear not trying any trial-and-error approaches.

Comparing the NASA TLX scores of the tasks that were identical in both studies showed a decrease in the perceived workload. Navigating with Maps resulted in an lower average NASA TLX score (from 30 to 26), as did deleting a contact (from 35 to 25). Even though the data shows that the perceived workload is lower with HelpMe, a larger control group would be necessary for definite claims.

To evaluate our concept we implemented a prototype with predefined overlays. The positive results are encouraging and suggest that integrating such assistance into everyday applications assists the inexperienced users without having a negative influence on the experienced ones.

Conclusion and Future Work

Our overall conclusion is that giving inexperienced smartphone users an option for assistance helps them figure out how to complete tasks on their own. The use of HelpMe can be helpful for older adult users that want to explore the full potential of smartphones.

The system can be improved by gathering more data about the user; eye tracking, face detection or physiological sensors (e.g., Emotionsense [11]) could detect user confusion. Eye tracking is now possible through front-facing smartphone cameras [5, 6, 15] and could be utilized to avoid overlaying help when users are reading text.

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