Help Kiosk: An Augmented Display System to Assist Older Adults to Learn How to Use Smart Phones

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ABSTRACT
Older adults have difficulty using and learning to use smart phones, in part because the displays are too small to provide effective interactive help. Our work explores the use of a large display to temporarily augment the small phone display to support older adults during learning episodes. We designed and implemented a learning system called Help Kiosk which contains unique features to scaffold the smart phone learning process for older adults. We conducted a mixed-methods user study with 16 older adults (55+) to understand the impact of this unique design approach, comparing it with the smart phone's official printed instruction manual. We found Help Kiosk gave participants more confidence that they were doing the tasks correctly, and helped minimize the need to switch their attention between the instructions and their phone.

Author Keywords
older adults; smart phone; learning; manual; large display; quantitative and qualitative evaluation

INTRODUCTION
Populations in both developed and developing countries are experiencing two significant changes, namely, (1) the rapid growth of the proportion of adults 65+ years of age, which is expected to comprise 27% and 15% of these nations' population by 2050, respectively [4, 11]; and (2) increasing mobile technology, specifically smart phone, adoption. There are lower adoption rates among older adults [2, 6], largely for two reasons. The first is the trouble learning to use a mobile device [1, 7, 9, 13]. And the second – assuming that a device has been learned – relates to the ongoing usability of that device such as complex UI design and small button size [7, 12].

Few past studies on learning needs have involved older adults, and even those that have, the findings do not give much insight into the unique learning needs of older adults [10, 7]. Leung et al. proposed an approach of augmenting a smart phone's small display with a larger display, such as a desktop monitor, to provide temporary additional screen real estate during learning sessions [8]. The system, namely Help Kiosk (HK), is based on the concept of an interactive instruction manual with additional supportive scaffolding [5]. However, it lacked a more controlled systematic evaluation including in-depth user feedback. Such a systematic evaluation is the primary goal of the current work. In order to conduct this evaluation, we iterated on the early HK design and implemented it to work with modern mobile smart phones.

We updated the HK design (e.g., adding the feature of displaying of task steps and highlighting, redesigning the Live View and demo video parts) and conducted a mixed-methods user study with 16 older adult (55+) novice users who completed six smart phone tasks, half with the help of manual instruction, and the other half with HK system. The results showed that it took a similar amount of time to execute commands for both the manual and HK system. However, the rich interview feedback reveals that participants found HK application more usable and easier to follow than the printed instruction manual.

HK SYSTEM DESIGN
The HK design is based on the concept of an instruction manual, found to be the learning method most preferred by older adults [8], and it provides additional real-time interactive guidance and feedback. We followed four design principles, building upon the previous prototype and existing guidelines: (1) support self-directed learning as users are able to repeat instructions as often as they want (2) utilize real-time device state to personalize experience as HK uses the phone's state to check whether or not each instruction has been correctly followed, which Carroll et al. [3] found to be difficult for new users. In addition, the Live View on the display allows users to minimize how often they look between the two devices, (3) provide both generic and specific instructions as HK presents each instruction step in three distinct ways (instruction pane, Live view and Demo video, Fig. 1), and (4) minimize demands on working memory by using larger fonts, and showing the smart phone's screen contents in the Live View on the large screen to reduce the need for visual swapping between screens.

Our HK prototype consists of a desktop computer with a 19" built in touchscreen monitor. The prototype connects to a Samsung Galaxy S7 smart phone via USB (instead of a wireless connection to reduce data transfer time). Other than enabling the debugging setting on the device, no additional software is needed on the smart phone to make it work with HK system.

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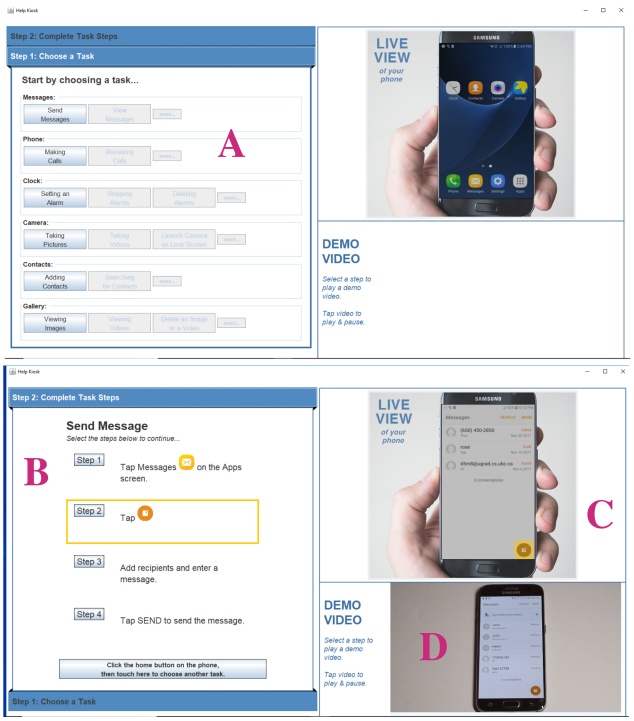

Figure 1. HK pane for choosing among tasks (A), and specific task instructions for Send Message task (B), as well as the live view for Step 2 of that task (C) and a video clip showing how to execute that step (D).

The program is written in Java. It also offers help for six tasks: making phone calls, sending messages, taking photos, viewing images, adding contacts, and setting alarms.

STUDY DESIGN

The goal of this mixed-methods study was two-fold: (1) to systematically gather older adults' comparative experience on the usability and usefulness of learning to perform tasks on a smart phone using both our HK system and the smart phone instruction manual and (2) to capture task completion performance of users for both HK and the manual learning systems. We used a 2 × 2 Mixed design with 2 learning system conditions (within-subjects: manual, HK) x 2 task groups (within-subjects: A, B). We employed a within-subject design where participants were exposed to both the systems, counterbalancing the order of exposure to both. Six tasks that we divided into two groups (task group A: setting alarm, sending a message, viewing an image, and task group B: making a phone call, adding a contact, taking a picture) where each participant performed all tasks in each of task group 3 times by counterbalancing the order of exposure to the groups. Thus, half of the participants completed the tasks in group A with their first system, then group B of tasks with second system. We recruited 16 participants ranged from age 55 to 81 years (M=65.9, SD=8.5) through a university paid-participant board and local senior centres, who own mobile phone, and consider themselves to be a beginner or novice user of smart phones.

The researchers first gave a brief description of the study followed by a short demonstration of HK system and the instruction manual. Then the participants filled out a short demographic survey. At this point, the researcher reminded participants about the "think aloud" protocol. The participant was assigned a system (either HK or manual) and a task group to start with a 5-minute break before seeing the second system. After each system, participants filled out a NASA-TLX questionnaire. Participants were then asked a series of questions in a semi-structured interview, which was audio recorded and transcribed for analysis. The study took 1 hour (avg.). Participants were given a small honorarium. The instruction manual was downloaded from the Samsung website and printed.

RESULTS

Quantitative: A mixed RM-ANOVA showed no main effect of system on completion time ($p > 0.05$). As expected, there was a significant main effect of task $F_{5,65} = 6.918$, $p < 0.05$, $\eta^2 = 0.347$), as some tasks were a bit more difficult than others. More participants reported that they felt they could learn more tasks with HK and their learning was "better supported" by HK, compared to the manual (8 vs 5 participants, respectively; 2 participants were undecided and 1 didn't respond).

Qualitative: To analyze qualitative user feedbacks, we conducted a thematic analysis focused on individual accounts and experiences, and targeted at specific design elements and choices of the HK prototype. Based on initial themes and categories that emerged, additional passes were done over the data to see if different participants' experiences were in concert or contrast with those themes. Firstly, in terms of the comparison between HK and the Manual, we learned that: (1) HK supports self-directed learning (participants felt that the kiosk empowered them to learn at their own speed, and repeat tasks as many times as they wished), (2) Manual is more comfortable (some participants said that the paper manual was easier to read), (3) HK requires less attention switching (participants commented that they did not need to switch between looking at HK and their phone as much as they did between the manual and their phone), (4) Manual might better support incidental learning (participants speculated being able to more easily encounter tasks with the manual), and (5) More advanced tasks needed (participants showed evidence that they may be more experienced with their smart phones than we expected when we recruited them). Secondly, we learned the following in terms of the three HK design elements: (1) instruction panel: even though the wording was identical, the instructions in HK were perceived to be easier to follow, (2) live view: it was very beneficial, enabling participants to know which steps they had already successfully accomplished, (3) demo video: it would be more useful if the tasks required more complex forms of touch interactions (e.g. pinching and swiping).

DISCUSSION AND FUTURE WORK

Our findings about the personalized learning experience of using Help Kiosk system suggest that it was successful at creating a space of self-directed learning. However, work is needed to expand the tasks offered, both to include more advanced tasks, and also more basic, out-of-the-box instructions. We found a considerable gap between seniors who have embraced the new technology, and those who still feel uncomfortable and intimidated by it. We heard over and over from participants who were slightly too skilled or familiar with our tasks that they would be interested in trying a version of Help Kiosk with more advanced tasks.

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