User Centric Design for Aging Population: Early Experiences and Lessons

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I. Problem Statement

Mobile technology has the potential to improve the health, wellbeing, and quality life for individuals and groups. For example, medical-related applications have been developed to assist doctors in caring for patients and to assist patients in self-managing chronic conditions, and to assist caregivers in caring for loved ones[1][2]. Though mobile technologies have been developed for a wide range of audiences, technology development has largely overlooked one of the fastest growing segments of the population–older adults users. Rapidly aging populations and increased lifespans are becoming more common, especially in developed countries[3]. Moreover, the majority of older adults desire to remain in their homes and communities and retain their independence–that is, to "age in place"[4]. There subsequently exists a tremendous opportunity for developing mobile technologies to meet the needs of this growing demographic. Nonetheless, previous efforts to develop mobile applications mainly used a "features based" approach without considering the physiological differences between users (e.g., joint mobility, or visual acuity). To design more age-friendly applications for older adults users it is necessary to first have better knowledge about older adults perceptions and experiences of mobile applications. To address this gap in knowledge, we conducted a study on older adults' attitudes and acceptance of a mobile device.

II. Our Approach

Participants and Recruitment: We invited 100 African American older adults age 55 and older living in Detroit that were recruited from the Wayne State University Institute of Gerontology's Healthier Black Elders Center Participant Resource Pool (PRP)[5].

Data Collection: We lent participants Android smartphone equipped with the Movisens XS[6] ecological momentary assessment (EMA) application. Participants used the phones for 7 consecutive days to report data about their daily activities and stress. The application was designed to sound an alarm four times per day (9 a.m., 1 p.m., 5 p.m, and 9 p.m.). Upon hearing the alarm, participants were required to answer a series of questions on the phone about what they were doing at that time and what they were doing in the previous two hours. Considering the differences between people, we anticipated that the older adults in our study would have varying levels familiarity with mobile devices. To maximize data quality and adherence we developed an in-depth, four-level participant training protocol (verbal overview, research demonstration, participant demonstration, and educational handout).

We then interviewed the first seven participants about their experience of using the EMA application and used their feedback to guide modifications to the EMA. After employing the modifications, we conducted 13 subsequent interviews to further evaluate our changes to the application.

III. Findings

A. Design Change Recommendations

Participants overwhelmingly reported that they were pleased with the opportunity to provide feed back about the EMA interface and user options and commented on how quickly they adapted to the mobile phone and software after receiving the training. Some participants even noted that they enjoyed the novelty of being involved in this type of research, as one participant state, "It was very nice and it was something that I experienced that I never had done before". In addition to participants' positive responses about being involved in the research, they also suggested a range of modifications to improve the EMA interface and user options. In table 1 and 2, we present interviewees' feedback and our corresponding changes. Our subsequent interviews were overwhelmingly positive, and yielded not further recommendations for change. Thus we interpreted the lack of further recommendations to signify that the initial changes were satisfactory to the group.

B. Discussion

In this paper, we presented data and findings about designing a training protocol and piloted testing a specific application among older adults to get a better understanding of older adults' user behaviors and perspectives on mobile applications. Our study suggests that older adults are open

TABLE I
CHANGES MADE TO THE EMA INTERFACE

Design Element	Feedback	Solution
Alarm Response Options: We included multiple options for responding to the alarm: answer the alarm, dismiss the alarm, and delay the alarm for 10 minutes or one hour.	Participants disliked the multiple response options and felt that this contributed to confusion over whether or not they had fully completed all of the EMA questions.	Two response options: Completing the EMA questions at the time of the alarm or "manual entry" option which allowed users to complete the questions any time outside of the initial alarm.
Idle Alarm: If participants failed to complete the EMA questions within a 2 minute period an additional alarm would sound to remind them to complete the question set.	Alarm was stressful and not needed. Participants would complete the questions once started at their own pace.	Idle Alarm was removed.
EMA Question Sets: Current time and 2-hours prior question sets were presented one immediately after the other.	The two consecutive question sets were confusing because the questions were very similar.	Text formatting on the second question set was changed to all capital letter for the word "TWO HOURS PRIOR".
Completion Notification: No cue was included to indicate to participants that they had successfully completed all of the EMA questions.	Participants were uncertain at time if they had completed the question sets correctly.	A smiley face icon with the words "Thank You" was added at the end of the question set to indicate that the participant had successfully completed all questions.

TABLE II
USER RELATED ISSUES AND SUBSEQUENT CHANGES

Design Element	Feedback	Solution
Activity Elaboration: Free-text option for recording daily activities	Some activity entries were too vague (e.g., I'm sitting)	The training protocol was revised to include specific instructions to participants to elaborate about the activity they were performing.
Typing Difficulty: Difficulties typing in free-text responses to questions	Issues such as arthritis in the hands, long nails and poor dexterity made it difficult for some participants to type in responses.	Participants were trained on using the voice-to-text option, which was overwhelmingly preferred over typing. Participants who opted to type in entries were offered a stylus to aid in typing.
Display Issue: More than one application was present on the phone's home screen	Some participants had difficulty remembering which application was the Movisens XS application	All unnecessary applications were deleted from the phones and those that could not be deleted were removed from the home screen

to experimenting and using mobile technology once be introduced the basic functions. In addition, participants in our study show great interests in exploring advanced functions of smartphones and additional mobile applications (e.g., taking photos by the camera app, or playing with other non-study associated applications). The feedback presented also suggests that developers should take into consideration age related physiological changes that may impact mobile technology use (e.g., visual and auditory, changes in joint mobility and tactile sense).

C. Conclusion and Future Directions

In conclusion, though older adults may have different user-needs and expectations when compared to usual mobile devices users, they are interested in and capable of manipulating their devices and associated applications. At the same time, we acknowledge the limitations of this study. Namely, the findings are derived from a small sample of geographically bounded older adult users, and participants' opinions are in relation to a specific mobile phone and software application. Nonetheless, the findings provide evidence of the willingness of older adults to engage with researchers when designing mobile technologies, and the benefits to the design process when their perspectives are sought out. We intend to use the findings from this study and a subsequent more in-depth study to develop and evaluate an "age-friendly" application design to make mobile devices more useful and accessible for older people to enjoy aging in place, as well as to increase the aging population's digital literacy capacity.

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