E. Nicol, A. Komninos and M.D. Dunlop, Investigating Mobile Text Entry for Older Adults, *Proc. MobileHCI 2014 Workshop on Reimagining Mobile Interfaces for Older adults*, in press 2014

Investigating Mobile Text Entry for Older Adults

Emma Nicol[1]
Emma.Nicol@strath.ac.uk

Andreas Komninos[1]
Andreas.Komninos@strath.ac.uk

Mark Dunlop[1]
Mark.Dunlop@strath.ac.uk

[1] Mobiquitous Lab
Computer and Information Sciences
University of Strathclyde, Glasgow G1 1XH
Scotland, UK

This paper was submitted and presented at the MobileHCI 2014 workshop on Re-imagining commonly used mobile interfaces for older adults, 23 September 2014.

Abstract
Text entry remains key to many tasks on touchscreen smartphones and is an important factor in the usability of such devices. The known problems of text entry can be particularly acute for older adults due to physical and cognitive issues associated with ageing. In a study of mobile text entry we employed a variety of participatory design techniques in order to develop novel keyboard layouts to address the requirements of this group of users. We report on the early findings and the methodological implications for further research in this area. Based on our results we argue that making the effort to involve older adults in the design process has benefits that could not otherwise be achieved.

Author Keywords
Text entry; older adults; participatory design

ACM Classification Keywords
H.5.2. User Interfaces: User Centered Design.

Introduction
Text entry is still core to mobile interactions such as email and web searching. Most smartphones have moved away from having a physical keyboard, relying instead on on-screen touch keyboards. Touchscreen keyboards have been shown to be slower and more error prone than traditional mini-physical keyboards

Fig 1: Map of mobile use with user annotations

Fig 2: Group discussion

(e.g. [5, 6]) but are popular as they permit full screen services and a larger reading area. While there have been many studies of text entry on touchscreens, there has been very little on the effects of ageing on text entry, particularly on modern touchscreen phones. Reduced visual acuity, motor control and working memory are all likely to have more of an impact on touchscreens than physical keyboards. Key recommendations by Fisk et al. [2] for designing for older adults are in stark contrast with typical smartphone touchscreen interactions that, for example, require almost zero force to activate buttons, have zero travel and no gaps between keys on high glass surfaces with reduced contrast in bright light. This means that natural ageing processes can make smartphone interaction particularly challenging for older adults.

While the mobile industry is currently focussed on targeting younger users, our aim is to develop innovative keyboard designs that are easier to use and less error-prone for older adults. Our preliminary studies showed that older users may be more willing to adopt new keyboard layouts than younger users, who were reluctant to move from standard QWERTY layouts. During a 2 year investigation of mobile text entry for older adults we are using a participatory design approach in a series of research workshops to identify key design criteria. We also aim to quantitatively measure touchscreen behaviour for older adults and compare with that of younger adults.

When considering how to investigate text entry with this group of users we found from the literature that so far a complete methodology for use with older adults has not yet been proposed or evaluated by researchers. In our studies we made use of a number of research techniques recommended for participatory design. In what follows we describe in brief each technique, how effective it was in use with older adults and what it allowed us to discover.

Participatory Design Sessions

Mapping exercise: Our first research session was designed to help us to explore the context of text entry and mobile use. Participants in groups of 4 were given a large map of a fictional town with images of locations where they might use text entry (Fig. 1, 2). Using stickers colour-coded for categories of mobile device

activity, groups identified places where they would enter text. Groups then gave a presentation on how they had made their decisions, which provided rich data (see Results section below for some examples).

Cultural Probes: At the close of the first session participants were given cultural probe pack [3] containing postcards probing mobile use and text entry activities and a disposable camera to take pictures related to their texting activities. In the following session, participants were asked to share their postcards and photos and, in groups, to present their most common and pressing issues.

Observational studies: In a small group setting we asked participants to complete a number of text entry tasks on their own mobile devices while we videoed and logged their interaction. We also asked them to try four novel keyboards and gained feedback in short semi-structured interviews.

Metaphor and paper prototyping: In a small group setting we discussed the topic of error correction on mobile devices using the cinematic term "blooper" as a metaphor [4] to avoided the language of mistakes or errors. We ran a post-it note exercise where participants described typical things that went wrong for them when entering text. We then demonstrated different solutions to error correction to motivate and gain feedback on attitudes to error correction. Following on from these exercises we asked participant groups to draw ideal designs on paper mobile phone templates (e.g. Fig. 3). A representative from each group presented the group's ideas to the others.

Lab studies and logging: After initial logging studies [7] showed different tap behaviors of older and younger users, we wanted to capture detailed key press data. We are currently conducting individual lab and longitudinal studies on a logging keyboard. In lab studies users performed a fixed set of tasks of varying types (from copying short phrases to describing images in a fixed time limit), while our longitudinal studies record text entry interaction behaviour over 2 weeks.

Results

The mapping exercise was successful in introducing the topic to the participants but it highlighted the importance of good task description, agreeing terminology and keeping participants focused (as per [1,2,6]): all 3 groups interpreted the task rather differently making the results interesting but not directly comparable. Topics that emerged included appropriateness of location for tasks, which we had not anticipated, novel uses of mobiles to support hospital visits and flexible use of multiple devices.

The postcards were successful in uncovering several mobile and texting issues. Many commented that on-screen buttons were too small to hit accurately and that screens were extremely sensitive. We got the impression that they had many problems with both text entry and accidentally tapping keyboard and other buttons (e.g. home, back and send buttons). The cameras were less successful as a research tool as many photos were of poor quality, and participants were less keen to share their photos than postcards. Participants were happy to present their issues to the others and some interesting dialogue developed as a result. Issues arising from these discussions included a frustration over the lack of support: in the absence of

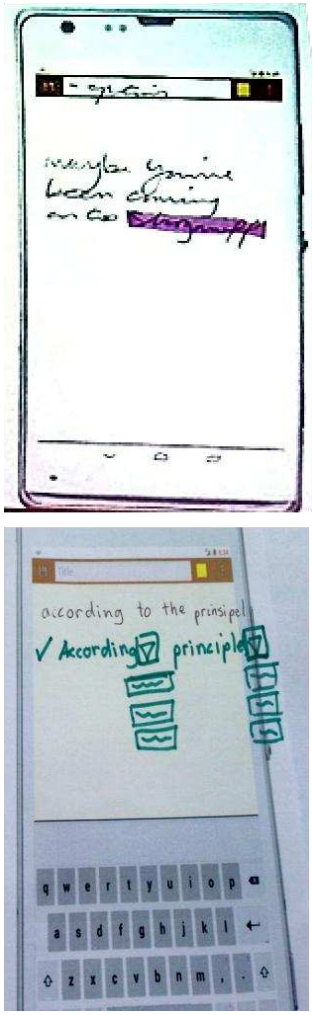

Fig 3: Paper prototypes of error correction solutions

manuals users struggled to understand their phones' capabilities and they were reluctant to use discussion forums etc. rather than manufacturers' publications.

The observational studies were effective in highlighting issues related to text entry itself: higher error rates with the first word in any message and the tendency of users to enter a "review mode" of what they had typed before committing/sending. Semi-structured interviews revealed an openness to trying new keyboard layouts with some showing a reluctance to rely on prediction. Indeed after first exposure in this session a number of participants have begun, without prompting, to use gesture typing [8] as their normal input method.

Using metaphor to investigate error correction resulted in some rich feedback about participants' preferences for solutions to deal with this and was a good lead in to the prototyping exercise. Tasks resulted in detailed hand-drawn and labeled prototypes (e.g. Fig 3) for which participants were able to explain the design rationale to the others. Auto-correction approaches were viewed with concern, while identification of mistakes for later review was widely suggested in the paper prototypes.

While the initial lab sessions were successful in gathering a large amount of logged data, we found it relatively difficult to recruit for these individual sessions rather than our normal social group setting. The tendency of older users to see participation as a social event is treated as a pitfall by earlier researchers.

Conclusions and further work

We have used several methods for our research into text entry for older adults. These have largely been successful and we have gained many insights about both text entry and how best to run studies. We are now conducting detailed analysis of log data, longitudinal studies and further workshop using interfaces inspired by our workshops to date.

Acknowledgements

We thank our participants for their time and effort, our Centre for Lifelong Learning for help in running studies, and EPSRC for funding under grant EP/K024647/1.

References

[1] Coleman, G. W., Gibson, L., Hanson, V. L., Bobrowicz, A., McKay, A.: Engaging the disengaged: how do we design technology for digitally excluded older adults?. *Proc. DIS*. ACM (2010)

[2] Fisk, A. D., Rogers, W. A., Charness, N., Czaja, S. J., Sharit, J. Designing for Older Adults: *Principles and Creative Human Factors Approaches*. CRC Press (2009).

[3] Gaver, B., Dunne, T., Pacenti, E.: Design: cultural probes. *Interactions*, 6(1). ACM (1999)

[4] Göllner, S., Lindenberg, J., Conradie, P., Le, J., Sametinger, F.: The Enchanted Neighborhood: Using Metaphorical Devices for the Inclusion of Seniors in the Co-designing Process. *Proc IAUD* (2010)

[5] Hoggan, E., Brewster, S. A., Johnston, J.: Investigating the effectiveness of tactile feedback for mobile touchscreens. *Proc. CHI*. ACM (2008)

[6] Lee, S., Zhai, S.: The performance of touch screen soft buttons. *Proc CHI*. ACM (2009)

[7] Dunlop, M.D., Komninos, A., Nicol, E., and Hamiltion, I: Shake-n-Tap: A Gesture Enhanced Keyboard for Older Adults. *MobileHCI*, ACM (2014)

[8] Kristensson, P. O., Shumin Z.. SHARK 2: a large vocabulary shorthand writing system for pen-based computers." *Proc. UIST*, ACM (2004)