Smartphone Text Entry in Cross-Application Tasks

for the Workshop on Inviscid Text Entry and Beyond

Toby Jia-Jun Li
Human-Computer Interaction Institute
Carnegie Mellon University
Pittsburgh, PA 15213, USA
tobyli@cs.cmu.edu

Brad A. Myers
Human-Computer Interaction Institute
Carnegie Mellon University
Pittsburgh, PA 15213, USA
bam@cs.cmu.edu

CHI'16 Workshop on Inviscid Text Entry and Beyond, 8 May 2016, San Jose, CA.

Abstract
In this position paper, we discuss our ongoing work on understanding the users' smartphone text entry behaviors and needs in cross-application tasks. We also propose a system that enables users to streamline context switch process in cross-application text entry tasks, and create automation for repetitive cross-application text entry tasks.

Author Keywords
Text Entry, Mobile, User Behavior, Interaction Techniques

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

Introduction
In recent years, the usage of smartphone apps has risen. Prior work finds that users on average spend more than an hour on mobile apps everyday [3,5]. Mobile has also overtaken PC in the time spend on the Internet[1] and the number of information queries[2]. A large

[1] http://money.cnn.com/2014/02/28/technology/mobile/mobile-apps-internet/

[2] http://searchengineland.com/its-official-google-says-more-searches-now-on-mobile-than-on-desktop-220369

number of tasks that were mostly done on regular computers before, including many with data entry components, are now often performed on mobile devices [1,2]. Many of such tasks also require the use of *multiple* applications – prior work suggests that users often need to switch among applications to satisfy their information needs [4,5] and therefore use multiple applications in single usage session [5,6].

Our preliminary data from smartphone usage tracking suggest that most usage sessions with text entry behaviors involve the use of multiple apps. We are working to identify interesting phenomenon in such sessions such as the use of explicit (copy-and-paste, "share to" mechanisms etc.) and implicit (retyping) data transfer between apps, repetitive data entry and the high percentage of structured data being entered. We are currently running two studies – a survey and a larger-scale in-situ study where we log detailed smartphone usage data (including every click, tap and keystroke) of participants for 2 weeks. By the time of the workshop, we should have completed this study and the analysis, and be able to report the unique characteristics about text entry behaviors in cross-app tasks.

Though still at the early stage of design, we propose a new system to improve the user's performance in text entry and multi-app tasks and hope to gain feedback and insights at this workshop. The new system will be a demonstrational interface that will allow users to automate repetitive cross-app tasks using a program-by-example technique. In the automations, parameters (like the options specified and the data entered) would be generalized, so users can avoid the repetitive entry of text, and only specify the parameters needed in a single interface instead of switching among applications repeatedly.

By participating in this workshop, we would like to share our findings about the characteristics of text entry behaviors in cross-app tasks, and discuss possible ideas to address the inefficacies in those tasks. We hope to connect to fellow researchers in the text entry community and discuss interesting real-world problems and use cases on which our proposed systems can help improve the users' performance.

Understanding the Task

Traditionally, test entry has been regarded as an isolated task and thus often evaluated using the time and errors during a text copy task as the only metrics. Much fruitful work has been done in the field of improving the performance of the text entry itself. In this position paper, we ask a different question: if we consider text entry as a component of a larger task, how can we optimize this larger task? This new question opens many opportunities beyond helping user type faster – can we instead reduce the amount of text to be entered? Can we minimize the control actions needed between typing into different locations? Can we use what we learned from the users' data entry to optimize the other parts of the task?

To address these questions, the first thing we need is to understand the characteristics of these tasks, especially about the text entry behaviors. As far as we are aware, no prior work has done a comprehensive study to try to understand the actual text entry tasks the users need to do. To fill this gap, we are currently running an in-situ user behavior logging study, attempting to answer the following questions: What kinds of data are

entered into smartphones? To what extent is the data entered repetitively, either across time or within a session? What fields in apps are those data entered into? What trigger the data entries? What are the "big tasks" for the data entries? How are the entered data transferred between apps?

We are conducting a 2-week in-situ field study with an interview and an exit interview to collect both objective and subjective data. For the in-situ study, we will recruit ~20 participants, in which we hope to have a diverse representation of gender, age, occupation, ethnicity and socioeconomic background. All participants must be at least 18 years old, active users of Android smartphones and English-speaking. A logging application will be installed on the participants' smartphone during the entrance interview and removed after the exit interview. The logging application logs the usage of smartphone applications, including all taps, clicks, keystrokes and application invocations. We also ask each participant to keep a diary, which we hope they can fill out to discuss any interesting multi-app activities they perform during the 2 weeks.

Expected Results

In the preliminary data and an online survey we conducted, we identify some interesting phenomenon for which we will investigate in the field study data.

1. High percentage of structured data in text entry: From the survey, the participants self-reported that not counting messaging, most data they entered into their phone are structured data (e.g. phone numbers, addresses, URLs, calendar entries). Only a fraction of respondents reported that they often type data into text editors on their phones.
2. High number of retyping: We notice that despite the existence of the clipboard, 85% of our survey respondents have retyped (typed something they see in one location on the phone into another location), mostly because of the high difficulty and limited availability of copy-and-paste functions on phones. We consider retyping to be the implicit means of data transfer between apps.
3. High repetitiveness: We find that a large percentage of text entries on smartphones are repetitive. This is mostly because the autofill function is often only available in browsers, but not in the third party mobile apps. Therefore, the users sometimes need to repetitively enter the same information (like their addresses) into different apps, or repetitively fill out the same form, especially when the app is poorly designed.

Proposed System

To relieve the users from the repetitive cross-app tasks, we are proposing a new interaction technique that allows users to interact with smartphones based on their tasks instead of having to deal with individual applications. Being at the design stage, we would like to gain feedback and comments from the text entry community to shape the design of the system and to identify interesting use cases and user groups that our system can help.

The interaction model between the users and the smartphones has been centered on the use of applications since the birth of smartphone, which was inherited from the interaction model on desktop computers. However, because of the difference in screen sizes between smartphones and computers, the vast majority of smartphones (except for some big "phablets") can

only display one active app in the foreground at a time. This means that the users have to constantly switch between apps for multi-app tasks. In contrast, computer users can simply keep all apps they need active on the screen.

Imagine that you are planning to have a dinner with your friend, some steps you may take are:

1. Ask if your friend is interested in having a dinner with you on Facebook Messenger.
2. Find a time that works for both of you on Google Calendar and create an entry.
3. Find a good restaurant to go to on Yelp.
4. Check the time and distance to that restaurant on Google Maps.
5. Get a ride to the dinner on Uber.

As shown by the above steps, a common task like that would involve entering information into of five apps with eight context switches, even assuming the user does not switch back-and-forth between chat and Yelp when deciding where to go. Such frequent context switches have negative effects on both the user experience and the interaction efficiency.

Aiming at breaking the boundary between smartphone apps and helping users focus on the task, we propose a new interaction technique aimed at automating users' generalizable repetitive tasks across smartphone apps using the demonstrational interface / programming-by-example approach. The tool will be capable of recognizing generalizable sequences of interactions, prompting users to demonstrate a task, determining parameters in the demonstration and creating an automation for the task with only a little extra effort from the users.

Let us take the dinner example from the previous paragraph. The proposed technique could recognize "inviting friends to dinner" as a generalizable task and create automation and determine parameters (like the person to invite, the type of restaurant desired, the type of Uber service needed etc.) by observing users' demonstration of the task and asking the users a few questions. As the result of this process, the user can easily repeat this "inviting friends to dinner" task in the future without necessarily dealing with all the involved apps, but only specifying the relevant parameters and entering needed data in one combined interface.

Biography

Toby Jia-Jun Li is a Ph.D. Student in the Human-Computer Interaction Institute in the School of Computer Science at Carnegie Mellon University. His research interests include human-computer interaction, interaction techniques and handheld devices. His current research focuses on understanding, optimizing and automating cross-app tasks on smartphones. Prior to joining CMU, he worked in GroupLens Research at the University of Minnesota on social computing, spatial information retrieval and Wikipedia research. Toby would attend the workshop.

Brad A. Myers is a Professor in the Human-Computer Interaction Institute in the School of Computer Science at Carnegie Mellon University. He is an IEEE Fellow, ACM Fellow, winner of nine best paper type awards and three Most Influential Paper Awards. He is also a member of the CHI Academy. His research interests include user interfaces, handheld computers, programming environments, programming by example, visual programming, and interaction techniques.

References

1. Patrick Baudisch and Christian Holz. 2010. My New PC is a Mobile Phone. *XRDS* 16, 4: 36–41. http://doi.org/10.1145/1764848.1764857
2. Genevieve Bell and Paul Dourish. 2007. Yesterday's Tomorrows: Notes on Ubiquitous Computing's Dominant Vision. *Personal Ubiquitous Comput.* 11, 2: 133–143. http://doi.org/10.1007/s00779-006-0071-x
3. Matthias Böhmer, Brent Hecht, Johannes Schöning, Antonio Krüger, and Gernot Bauer. 2011. Falling Asleep with Angry Birds, Facebook and Kindle: A Large Scale Study on Mobile Application Usage. *Proceedings of the 13th International Conference on Human Computer Interaction with Mobile Devices and Services*, ACM, 47–56. http://doi.org/10.1145/2037373.2037383
4. Barry Brown, Moira McGregor, and Eric Laurier. 2013. iPhone in Vivo: Video Analysis of Mobile Device Use. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM, 1031–1040. http://doi.org/10.1145/2470654.2466132
5. Juan Pablo Carrascal and Karen Church. 2015. An In-Situ Study of Mobile App & Mobile Search Interactions. *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*, ACM, 2739–2748. http://doi.org/10.1145/2702123.2702486
6. Simon L. Jones, Denzil Ferreira, Simo Hosio, Jorge Goncalves, and Vassilis Kostakos. 2015. Revisitation Analysis of Smartphone App Use. *Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing*, ACM, 1197–1208. http://doi.org/10.1145/2750858.2807542