Investigating Hand-Size and Mobile Touch Interactions

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ABSTRACT
UPDATED—August 16, 2016. This sample paper describes the formatting requirements for SIGCHI conference proceedings, and offers recommendations on writing for the worldwide SIGCHI readership. Please review this document even if you have submitted to SIGCHI conferences before, as some format details have changed relative to previous years. Abstracts should be about 150 words and are required.

ACM Classification Keywords
H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous; See http://acm.org/about/class/1998/ for the full list of ACM classifiers. This section is required.

Author Keywords
Authors' choice; of terms; separated; by semicolons; include commas, within terms only; required.

——————Sarah ————————————-

INTRODUCTION
Interaction with your personal mobile device is an individual daily routine. Devices are increasingly smart and have plenty of functions. As today's mobile devices vary highly in their dimensions, interaction has different levels of difficulties. One or two hands might be necessary for different tasks.
People have different hand sizes and tend to have different device sizes, although that might not be closely interlinked. Mobile touch interactions differ widely with hand and device size.
Besides mobility, personalization is an important aspect. Our smartphone can only be smart based on our personal information, like for example our residence, contacts and browsing habits.
Our hand size could be another personalization aspect and make our devices even smarter. If my device knows about my hand size, it could for instance adapt the layout to help us reaching the important interaction elements.
The paper is organized as follows ...

——————Iris ————————————-

CHI'16, May 07–12, 2016, San Jose, CA, USA

ISBN 123-4567-24-567/08/06. . . $15.00
DOI: http://dx.doi.org/10.475/123_4

RELATED WORK
Parhi et al. performed a study about the error rates and preferred positions of different sized targets on a screen. They found out that as the target's size increases the error rate and time to reach decreases. Users also preferred the middle of the screen in contrast to the upper left and lower right corner [5]. Another study by Karlson et al. also demonstrates that the middle of the screen is the easiest to reach for a user while reaching the corners is more time consuming [4]. Buschek and Alt also took the hand size into consideration and discovered that users with smaller hands show a larger y-offset in the upper left corner but are more accurate in the lower area of the screen when trying to hit a target [3]. Bergstrom et al. defined a functional area which is the reachable region of a user's thumb without repositioning his hand. Smaller hands also show a lesser functional area [1]. As observed by Boring et al. users reposition their hand in order to reach certain areas of the screen [2].

STUDY
In order to find correlations between a users's hand size and his mobile touch interactions we implemented an android application to measure data for different interactions.

Study Design
Since we wanted the measured data to be as natural as possible we chose to investigate four main gestures which users have to perform regularly when operating a smartphone: tapping, swiping, scrolling and zooming. The latter was tested in two tasks which concludes in five tasks in total. The user was allowed to adapt his hand position while performing these tasks. At the beginning of our exploratory study it was unclear whether this natural behaviour could deliver any useful results at all. This is why we chose to add a sixth unnatural task for which the hand position was predetermined. The radius of the user's thumb was meausured while he was holding the phone next to the heel of the hand. The specific tasks were designed as followed:

- Radius task: The user was supposed to swipe a quarter circle from the right edge of the screen to the lower left
- Tapping task: The user was instructed to hit small crosses on the screen as pecisely as possible. 144 crosses appeared in an randomized order
- Scrolling task: The user had to scroll a list from top to bottom

- Swiping task: The user was supposed to swipe a slider from left to right. Four slider positions were tested: top, middle, bottom and diagonal
- Maximum zooming task: The user had to zoom a blue rectangle as far as possible with one zoom gesture
- Frame zooming task: The user was instructed to zoom a blue rectangle to fit into a frame. Three frame sizes were tested: small, medium and large. The user was allowed to execute multiple zoom gestures

The phone we used for our study was the HTC one max with a screen size of 5.9 inches. The study design was within subjects so all participants performed all of the tasks. The first one always was the unnatural interaction followed by the rest in an randomized order. It was also neccessary to measure the participants' hands in order to compare the hand sizes to the measured data delivered by our application. We chose to measure the participants' hand length, width, total span (from thumb to pinky finger) and zooming span (from thumb to index finger) in order to have more options for possible correlations.

App
The android application implemented for this study contained a screen for entering data about the user (hand measurements, age and gender). Before each task some instructions about the assignment were displayed. While performing the tasks, the application tracked different features which were stored into a database. These comprised of the x- and y- positions of the touch events and sensor data about acceleration, rotation and orientation. Task specific features were the number of scrolls, zooming span, timestamps etc. TODO: Screenshots von tasks

Participants
The 62 participants of this study were between 18 and 36 years old, 36 males and 26 females. Their hand lengths differed between 152 and 224 mm.

——————Sarah ————————————-

Procedure
The participants have been invited to a 15 minute time slot to take part in our hand measurement study. They could receive credits or an amazon voucher for their participation. In order to allow the usage of their hand and touch data, they had to sign a letter of agreement.
At first, the participants hand dimensions were measured manually as described before. Their data was then entered directly into our app. The participants started with the radius task in a predetermined hand position. After that, the tasks came up in a random order according to a latin square. The participants were free in solving the tasks, except they were only allowed to use one hand. For the zooming tasks, participants were instructed to use the other hand as well or to leave the device on the table.

——————Jonas ————————————-
=> was haben wir ausgewertet
"Signifikanz nicht untersucht, da nicht explorativ" !!!!! ... am interessantesten war dieses und jenes ... darauf eingehen => Plot zeigen und erlÃd'utern

RESULTS
=> das korreliert mit xy

DISCUSSION
——————Sarah ————————————-

CONCLUSION AND FUTURE WORK
We came up with different challenges when investigating hand size and mobile touch interactions. In our study, it was hardly possible to determine the user's hand size from his mobile touch interactions during our tasks.
We could show a higher correlation between touch interaction and hand size when we determined the hand position. As this might be uncomfortable for users, the other tasks in our study were designed in such a way that hand position is free and left over to the user.
Further investigations should eventually determine hand positions in order to evaluate the user's hand size. As the most promising result we got was from our radius task, this could eventually be used to predict the user's hand size.
Knowing about the user's hand size could then enhance mobile interaction. If our mobile devices know about our hand sizes, they could adapt the user interfaces in order to facilitate the interaction. Navigation bars and other important UI Elements could be moved to make them more reachable.

- Conclusion: am vielversprechendsten ist vermutlich ... Wie wÃijrde man speziell dieses noch in neuer Studie untersuchen
- weitere Daten angucken und evaluieren
- make mobile interaction smarter (Bezug zur Introduction nehmen)

REFERENCES FORMAT

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