COMBINING AUXILIARY FINGER INPUT WITH THUMB TOUCH FOR SINGLE-HANDED MOBILE DEVICE INTERFACES

by

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Abstract

This thesis reports on the use of auxiliary finger input to complement touch-only interactions on mobile devices. While a majority of touchscreen based mobile devices support multi-touch input, mobile device interactions in one-handed usage scenarios are usually limited to a single point of contact with the screen. In most cases, the thumb is the preferred source of touch input. Selecting user interface elements, such as buttons and sliders, requires frequent movement of the thumb, occludes a display, and, to reach targets, demands frequent adjustments of grip.

To tackle these usability problems of single-handed usage scenarios, we explored the use of the auxiliary fingers — that is, the fingers that grip, support, and make contact with a mobile device — as additional input channels. Sensing input from the auxiliary fingers might lead to significantly less thumb movement, with target selection and other interactions distributed across all five digits. We built a series of mobile device prototypes that sense isometric pressure at different areas on their surfaces. To evaluate the performance of this interaction paradigm, we measured task completion times and error rates for common mobile tasks, including document formatting, application switching, and map navigation, and validated that the use of additional fingers for input led to performance gains. We follow-up with a study to measure each finger's ability to apply pressure on the side of the device and measured the effect of this pressure on the thumb's range of motion around the screen. Finally, we provide software and hardware design recommendations based on these studies.

Co-Authorship

The prototype design and experimental evaluation on pages 24-43 were conducted collaboratively with David Holman and Amartya Banerjee.

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