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Interacting with Computers 17 (2005) 229–250
Interacting with Computers
www.elsevier.com/locate/intcom

In search of effective text input interfaces for off the desktop computing

Shumin Zhai*, Per-Ola Kristensson, Barton A. Smith

IBM Almaden Research Center,[1] *NEW-B2, 650 Harry Road, San Jose, CA 95120, USA*

Received 3 November 2003; accepted 10 December 2003

Available online 20 February 2004

Abstract

It is generally recognized that today's frontier of HCI research lies beyond the traditional desktop computers whose GUI interfaces were built on the foundation of display—pointing device—full keyboard. Many interface challenges arise without such a physical UI foundation. Text writing—ranging from entering URLs and search queries, filling forms, typing commands, to taking notes and writing emails and chat messages—is one of the hard problems awaiting for solutions in off-desktop computing. This paper summarizes and synthesizes a research program on this topic at the IBM Almaden Research Center. It analyzes various dimensions that constitute a good text input interface; briefly reviews related literature; discusses the evaluation methodology issues of text input; presents the major ideas and results of two systems, ATOMIK and SHARK; and points out current and future directions in the area from our current vantage point.

Keywords: Text input; Pervasive; Mobile; Off-desktop computing; Shorthand; Gesture; Stylus; Virtual keyboard

1. Introduction

Desktop computers, as well as their more mobile cousins—laptop computers, take the form of 'workstations' featuring a large and personal display, a pointing device,

* Corresponding author. Tel.: +1-408-927-112.
E-mail address: zhai@almaden.ibm.com (S. Zhai).

[1] Alison Sue, Clemens Drews, Paul Lee, Johnny Accot, Michael Hunter and Jingtao Wang have also significantly contributed to the work reported in this overview paper and most of them have co-authored separate research papers cited in the text. Per-Ola Kristensson (Linköpings universitet, Sweden), Paul Lee (Stanford), Michael Hunter (BYU), and Jingtao Wang (UC Berkeley) were members of this project during their internships at the IBM Almaden Research Center in different periods of time.

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doi:10.1016/j.intcom.2003.12.007

and a keyboard evolved from the typewriter. The display-pointing device-keyboard tripod forms the physical foundation of today's GUI interfaces.

Against this background, it is generally recognized that today's frontier of HCI research lies beyond the traditional desktop computer. Increasingly computing could be embedded in work and life environments, possibly with wall sized displays, or takes place in various mobile devices such as PDAs, Tablet PCs, or mobile phones. Off-desktop computing without the traditional display-pointing device-keyboard foundation faces many user interface challenges. Some will be surprisingly hard to solve. Text input is one of them. Text writing—including writing emails and chat messages, filling forms, typing commands, taking notes, authoring articles, and coding programs—constitutes one of the most frequent computer user tasks.

A good textual interface has many desired dimensions. First, it should be efficient. An average user with sufficient amount of practice should be able to write text at a sufficiently fast speed without making many errors. Second, it should have a low initial usability threshold and a rapid learning curve. Third, it should impose a low cognitive, perceptual, and motor demand on the user. Fourth, it should be fun to use, although, fun could well be a product of the first three dimensions. Fifth, it should be easy to access. Any requirement of attaching devices to the user, or even picking up and mounting a headset as in speech recognition, can be a significant impediment to frequent and constant use. For mobile computing, a compact form factor is obviously also important.

This paper first analyzes various dimensions that a comprehensive evaluation method should consider. It then briefly reviews the QWERTY typewriter keyboard and other recent textual interfaces related to our work. We then focus on synthesizing, updating, revising and summarizing the major ideas and results of our own research in this area. The paper ends with issues and directions we believe are critical to future research.

2. Evaluation methods

Text typing involves rather complex and multi-faceted perceptual, cognitive and motor processes (Cooper, 1983). Because of this complexity, there is no one standard or best evaluation method in the field of text input research. Even in traditional typewriting research, a clear-cut conclusion has rarely been reached on issues such as the relative superiority of the QWERTY vs. Dvorak layout (Lewis et al., 1997; Yamada, 1980). Developing a standard set of tasks for evaluating text input methods would be an important contribution to the field. Such a battery of procedures or tasks should consider at least the following aspects and issues of text input.

1. *Ultimate performance*. The eventual performance for an average user is often the most important goal in designing a new input method. The effective speed is usually the first question that comes to the user's mind when facing a new method. Unfortunately, it is also a very difficult question to answer, because the user's speed is a function of practice and many other variables. Without a substantial amount of training, what is measured is not going to be close to the ultimate performance. Substantial amount of training is always costly, especially if more than a few participants are employed.