
Intuitive Metaphors for Interacting with Mobile Computers

Heinrich Schmitzberger

Institut für Pervasive Computing
Johannes Kepler University Linz
Altenbergerstr. 69
+43 70 24 68 13 40
heinrich@pervasive.jku.at
www.pervasive-computing.at

PhD-Supervision: **Univ.-Prof. Dr. Alois Ferscha**



Copyright is held by the author/owner(s).
Doctoral Seminar, Linz, 2006

Abstract

Since PDAs, mobile phones and portable multimedia players have become our constant companions in every day life we are experiencing difficulties interacting with these devices. Though we've grown accustomed to desktop computing user interfaces these metaphors unfortunately don't apply to the needs of mobile computers. It seems quite obvious that the increasing of portability leads to a decreased usability.

The aim of my thesis consists in finding novel methods for interacting with mobile devices making them easier to access while safer to operate. My research focuses on both input and output methods as well.

Keywords

Mobile computing, gesture tracking, handwriting recognition, human-computer interaction, everywhere displays.

Problem Statement and Research Question

As Fukumoto stated in [1], there are three factors required for mobile computing devices: "Portability", "Usability", and "Constancy". First of all mobile devices need to be compact and light weight. Additionally they must be easy and intuitive to use despite their small

size. And finally they need to be able to handle continuous interaction with their user.

These requirements are hardly met all at once down to the present day. While modern mobile devices satisfy the demand for portability, their user interface is unintuitive and cumbersome restraining their potential. My research work therefore concentrates on two major issues.

As first issue the means of data input must be addressed. Conventional input metaphors as typing on downsized keyboards or pointing via stylus have proven inconvenient. The bigger the amount of data we want to input the longer it will take us while frustration towards mobile computing devices evolves. If we want to improve consumer acceptance it is necessary to identify the methods that users understand as most intuitive. To guarantee usability we must make use of metaphors in mobile computing that have approved in real life interaction.

The second problem is posed by the very limited amount of screen space on which to display information. As a matter of fact, vision plays the most important role when it comes to perceiving information. However, physically enlarging the screen would contradict the portability constraint as the devices must be able to fit into the hand or pocket to be easily carried. Therefore novel approaches of extending the limited displays of mobile computers need to be developed.

Reflecting on the issues mentioned above my claim to this field of research can be described as follows: mobile computing needs to make use of new metaphors and interaction techniques that abstract the inconveniences of mobile solutions while concentrating

on the fundamental aspect of making information portable and accessible - anyplace and anytime.

Approach and Methodology

I conduct my research on an experimental basis. Fundamentally I try to explore conventional interaction methods of people with all kinds of devices and things of daily use identifying the intuitiveness of their action. I furthermore intend to draw conclusions on the acceptance of the metaphors that appear.

I'm approaching my topic based on the thought that the only broadly acceptable means for intuitive human computer interaction must arise from the way we are dealing with things we don't perceive as technology in everyday life.

To validate the quality of my research contribution I will have people working with several prototypes derived from the most usable and intuitive metaphors determined by my work. If a user is confronted with a new interface the most appropriate way to determine its suitability is the measurement of time the user needs to handle it right. I claim that the more the user is familiar with its basic handling metaphor, the quicker he will be able to operate it.

Related Work

In the following I try to summarize briefly the publications that influenced my work so far.

First to be mentioned in this section is the work by Lumsden and Brewster [2] in which a paradigm shift from usual mobile computing towards multimodal interaction techniques is proposed. Their work demonstrates the feasibility of alternative interfaces

which use hand and head gestures for input combined with audio feedback. Further to be mentioned is an earlier contribution from Brewster [3] in which he identifies the problem of the lack of displaying space on mobile computers.

Investigating different possibilities of interacting with mobile computers I mainly focus on gesture recognition. In their publication from 1987 [4] Zimmerman et al. explored the Data Glove, a device integrated in a glove that provided real-time gesture, position and orientation information. Based on this early idea Tsukada and Yasumara presented the "Ubi-Finger" [5]. This work introduced a portable input device to be applied to the index finger enabling its user to operate several electronic devices (such as a PDA or a stereo) by intuitive hand gestures.

A different while impressive approach to the topic of hand gesture tracking is stated by [6]. In this publication a smart laser-scanner is described. This device is capable of tracking hand and finger gestures posing in not yet portable but interesting alternative to ordinary keyboard/mouse input.

Preliminary Results

As my contribution to this field of research I try to prove that the increase of usability need not lead to a decreased portability. Therefore the mobile computing device has to vanish away from the user's field of perception becoming a back-end for data input/output. I want to show that it is possible to interface with mobile computers by very intuitive and inconsiderable means making use of resources that haven't been considered as such yet.

Conclusions and Future Steps

To accomplish my goals I have to investigate "human non-computer interaction". In this area some research has already been done. I currently focus on identifying hand gestures and the recognition of handwriting, dealing with problems such as tremor cancellation.

As I am at the beginning of my research in this area I would welcome additional expertise when it comes to the sensory evaluation of gesture tracked data. I am currently working with inertial sensors and have already encountered several difficulties with the products on the market.

References

- [1] M. Fukumoto. Can you input on 24-hours!? – wearable interfaces. *IPSJ Magazine* Vol. 41. 2000.
- [2] J. Lumsden and S. Brewster. 2003. A paradigm shift: alternative interaction techniques for use with mobile & wearable devices. *Conference of the Centre For Advanced Studies on Collaborative Research*. IBM Press, 197-210.
- [3] S. Brewster. 2002. Overcoming the Lack of Screen Space on Mobile Computers. *Personal Ubiquitous Comput.* 6, 3 (Jan. 2002), 188-205.
- [4] T. G. Zimmerman, J. Lanier, C. Blanchard, S. Bryson, and Y. Harvill. 1987. A hand gesture interface device. *SIGCHI/GI Conference on Human Factors in Computing Systems and Graphics interface*.
- [5] K. Tsukada, M. Yasumura(2002). Ubi-Finger: Gesture Input Device for Mobile Use. *Proceedings of APCHI 2002*, Vol. 1, pp 388--400.
- [6] Á. Cassinelli, S. Perrin, and M. Ishikawa. 2005. Smart laser-scanner for 3D human-machine interface. In *CHI '05 Extended Abstracts on Human Factors in Computing Systems* (Portland, OR, USA, April 02 - 07, 2005). CHI '05. ACM Press, New York, NY, 1138-1139.