

Understanding Mobile Human-Computer Interaction

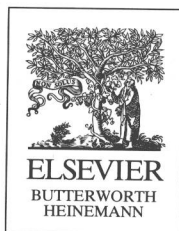
Steve Love



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To Cathy, with love

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Glossary

Computer–Human Interaction	CHI
Computer Supported Collaborative Learning	CSCL
Computer Supported Collaborative Work	CSCW
Community of Practice	CoP
General Package Service	GPS
General Package Radio Service	GPRS
Global Positioning Service	GPS
Graphical User Interface	GUI
Human Centred Design	HCD
Human–Computer Interaction	HCI
Hyper Text Transfer Protocol	HTTP
Information and Communication Technology	ICT
Mobile Information Device Profile	MIDP
Pay No Attention to the Man BehInd the Curtain	PNAMBIC
Personal Digital Assistants	PDA
Short Message Service	SMS
Statistical Package for the Social Sciences	SPSS
Visual Display Terminals	VDUs
Wireless Fidelity	WiFi
Wireless Application Protocol	WAP
Wireless Local Area Network	WLAN
Wizard of Oz	WoZ
World Wide Web	WWW

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Introduction to mobile human–computer interaction

BACKGROUND

A few years ago I was on a train travelling back to Glasgow from Edinburgh. Not long after we started the journey, the girl I was standing next to began to talk to me. I was a bit surprised as I didn't know the girl and instead of asking me something like 'how long does this train take to get to Glasgow?' she asked me how I was and what my day had been like. Although surprised, I told her I was ok; had a good day at work and that I was looking forward to watching the Scotland soccer match on TV later that evening.

As I spoke, I saw the girl starting to glare at me and as she turned away from me I heard her say 'ok, I'll call you later'. It was at this point that I realised that the girl had been talking into her hands-free mobile phone microphone and not to me. The rest of the journey continued in silence.

This example, in its own way, highlights what this book is about. Mobile communications such as mobile phones and Personal Digital Assistants

(PDAs) are influencing how we go about our daily lives from both a social and economic perspective. This book is about mobile devices and the factors you should be aware of, if you are interested in carrying out research in the area known as mobile human–computer interaction.

INTRODUCTION

This chapter aims to introduce you to the discipline of human–computer interaction (HCI). It will talk about the component disciplines of HCI and how it is an interdisciplinary subject, bringing together knowledge from different disciplines such as Psychology, Computer Science and Sociology. The chapter will also describe the various types of mobile devices that we have available to us today as well as the types of connectivity we use to get the most from these devices and mobile applications and services. The chapter finishes off with an overview of the topics that will be covered in the remaining chapters of the book.

WHAT IS HUMAN–COMPUTER INTERACTION?

The first thing we have to do is to define what is meant by the term *human–computer interaction*. For the purposes of this book HCI will be defined as the study of the relationship (*interaction*) between people and mobile computer systems and applications that they use on a daily basis. This can range from using a PDA to upload information about the HCI module you may be studying as part of your university course, to updating the credit balance on your mobile phone. Alas, right away we have to add a caveat to our definition. In the United States and countries such as Australia, New Zealand and South Africa, the term computer–human interaction (CHI) is used instead of HCI. So, if you are looking up references for a term paper or carrying out revision for your exam, this is something you should bear in mind!

So what does this term HCI actually mean, now that we have a definition before us? HCI is concerned with investigating the relationship between people and computer systems and applications. For the purposes of this book, we are concerned with understanding the users, their various capabilities and expectations and how these can be taken into consideration in the mobile system or application design. In terms of mobile systems design (or any type of design for that matter), the

emphasis should always be on the users. Firstly, the system designer should set out to understand, from the outset, what the users want to use the mobile device for – what tasks they want to perform when using the system. Secondly, what characteristics of the user could have a significant effect on their performance with the system; for example, age or a physical disability such as blindness. Thirdly, once the designer has taken into consideration the needs of the users, the next stage should be to set out to develop a system that is designed to meet the needs that have been identified at the start of the process. Then the designer has to test the system in order to evaluate it to see if it meets users' needs and if they find it satisfying to use. On the basis of the feedback the designer receives at the evaluation stage, there will probably have to be an updated version of the service or application produced.

Another key aspect to this is an understanding of the environment in which the users are employing the technology (also known as *context of use*) as this can have a major impact on their ability to interact with the mobile device or application in an effective, efficient and satisfying way. For example, using your mobile phone in a dynamic environment such as the train or even walking down the street, will result in you having different requirements and expectations from your service or application. One thing you definitely want is to make sure that if you are on the train, you don't lose your wireless connection and thus not be able to update the latest sales figure on to your main database back at the office.

As can be determined from above, understanding the relationship between humans and mobile devices and applications is not necessarily an easy process. However, the aim of this book is to provide you with an insight into this process and hopefully in doing so, it will provide you with an understanding of the major factors to be considered when you are conducting your own mobile HCI research project.

DISCIPLINES INVOLVED IN MOBILE HUMAN–COMPUTER INTERACTION

Human–computer interaction is a multidisciplinary area with various academic subjects making contributions. This is a reflection of the complicated nature of an individual's interaction with a computer system. This includes factors such as an understanding of the user and the task the user wants to perform with the system, understanding of the design

tools, software packages that are needed to achieve this and an understanding of software engineering tools.

What follows is a list of some of the main disciplines involved in the study of mobile human–computer interaction along with a brief description of the contribution each one makes to this field of study.

Psychology

Psychology has made (and continues to make) a major contribution to the HCI discipline. Many of the research methods and system evaluation techniques currently used in mobile HCI research are borrowed from Psychology. For example, if you are interested in finding out people's attitude towards using a new mobile phone-based tourist information guide you will probably develop a questionnaire using questionnaire design techniques that can be explained in many introductory textbooks on Psychological research methods (e.g. Coolican, 2000). As well as attitude measures, performance measures that are used in mobile HCI research studies (and HCI studies in general) come from the area of experimental psychology; for example, timing how long it takes people to complete a specific task using a mobile phone-based tourist information guide. Information on research methods are discussed in more detail in Chapters 4 and 5.

Understanding users and their needs is a key aspect in the design of mobile systems, devices and applications so that they will be easy and enjoyable to use. Individual user characteristics such as age, or personality physical disabilities such as blindness, all have an affect on users' performance when they are using mobile applications and systems, and these individual differences can also affect people's attitude towards the mobile service or device that they interact with. Individual differences and their impact on mobile HCI research and design is a topic that I will discuss in greater detail in Chapter 3.

Computer Science

Computer Science (along with Engineering) is responsible for providing software tools to develop the interfaces that users need to interact with system. These include software development tools such as visual basic and Java™ 2 Platform, Micro Edition (J2ME™).

What do these tools allow you to do? The Java™ 2 Platform, Micro Edition (J2ME™) is a software development tool that is used for the development of devices such as mobile phones and PDAs (personal digital assistants). The platform has a mobile information device profile (MIDP) whose features include what is known as end-to-end security by protecting the device against any unauthorised attempt by an outside party to access data held on your device. This is very important as you move about in a dynamic mobile environment. In addition, this platform allows you to connect and browse the internet using connection standards such as hyper text transfer protocol (http).

As well as this, MIDP has features that allow the development of user interfaces that take into consideration the limited screen space available on mobile devices and the navigational requirements necessary for usable mobile applications.

Sociology

Sociologists working in this area are responsible for looking at socio-technical aspects of HCI. For example, there is a growing body of research that has been carried out by sociologists that investigates the impact of mobile technology in social situations. For example, Ling (2002) carried out a study investigating the social impact of mobile phone use in public places. In this study he found that people perceived mobile phone use in places such as restaurants as unacceptable, partly because individuals located near mobile phone users felt coerced into eavesdropping into their conversation.

Sociologists bring methods and techniques from the social sciences (e.g. observational studies, ethnography) that can be used in the design and evaluation of mobile devices and applications. A clear example of the Sociological contribution to mobile HCI research which focuses on social usability is described in Chapter 6.

Design

People working in this area are concerned with looking at the design layout of the interface (e.g. colours, positioning of text or graphics on a screen of a PDA). This is a crucial area of mobile HCI research due to the limited screen space available for most mobile devices. Therefore, it is crucial that services and applications reflect this limitation by reducing

information complexity to fit the parameters of the mobile device, without losing any substantial content.

Information systems

People who work in this area are interested in investigating how people interact with information and technologies in an organisational, managerial and business context. In an organisational context, information system professionals and researchers are interested in looking at ways in which mobile technologies and mobile applications can be used to make an organisation more effective in conducting its business on a day-to-day business. For example, if you have a team of distributed workers (e.g. photocopy machine service engineers) carrying out their daily tasks in various geographical locations, it is important that the company can harness mobile technology to co-ordinate the work activities of the team members in order to provide support in terms of scheduling appointments and providing back-up should a problem arise when the engineer is on location at a job (e.g. finding out how long it will take to order a specific part needed to fix the photocopier). This issue of the mobile worker is a topic that will be covered in more detail in Chapter 6.

As well as the mobile worker, there is the globalisation aspect to consider. For example, people across the world can have access to the internet via a mobile phone and a PDA. As a result of this, service providers need to take into consideration the cross-cultural differences in terms of beliefs and values, and the degree of technical sophistication, as these can all have an impact on the uptake and use of services.

Know Thy User

One key aspect to emerge from looking at the different disciplines involved in mobile HCI research and design is that each perspective aims to keep the user and their needs and requirements central to the work they are undertaking. Although sometimes, when you use a particular mobile application, this may not seem immediately obvious to you.

MOBILE DEVICES

Having considered some of the major disciplines which make a contribution to mobile HCI research and design, it is now worth reviewing mobile devices themselves.

Mobile phones

The growth of mobile phone usage and the development in mobile phone technology has probably had the most significant impact on the way we communicate with each other (with the exception of the internet) over the past 10 years or so. In 2003, figures released by the International Telecommunications Union (ITU), stated that there were about 1,162 million mobile telephone subscriptions worldwide. If that doesn't make an impression think about it in this way: there are probably now more people in the world who have a mobile phone subscription than those who have a landline subscription.

One factor that helped the proliferation of mobile phone use in developed societies in the late 1990s was the decreasing cost of using mobile technology (Vaananen-Vainio-Mattila and Ruska, 2000). In addition, the development of mobile telecommunications technologies such as Wireless Application Protocol (WAP) and iMode, allowed people to use their mobile phones not only to make phone calls but also to use services such as short message service (SMS), access information services from the web (e.g. news headlines) and send and receive e-mails.

Unfortunately for the mobile phone service providers, the launch of WAP-enabled mobile phones did not lead to a rush of people queuing up to buy them. There were several reasons for this. One factor which certainly impacted on the uptake by users was that WAP technology required users to dial-up to get an internet connection. This was often a slow and laborious process (not to mention the cost factor). On the other hand, iMode fared better in Japan (where the technology was originally developed) due to its ability to provide a constant internet connection for its users. Once people did get their WAP access to the internet, they found that they could only get a stripped-down version of the net, with most of the information coming in text format and a limited range of services to choose from (e.g. sports headlines, news and weather). In addition, it appeared that the service providers had not really taken into consideration the limited size of a mobile phone screen and the impact this would have on the presentation of information as well as the limited memory capacity of these phones.

However, one major social phenomenon emerged at this time – the uptake of the SMS. The popularity of 'text messaging', as it became known here in the United Kingdom, took the mobile phone service providers by surprise. It was seized upon initially by teenagers and became a fundamental way for them to maintain social relationships with

their friends (Ito, 2001, Taylor and Harper, 2002). Now older sections of the population regularly use SMS texting as well. There has even been an SMS language developed to help people get round the tedium of typing with a 10-key keypad.

Despite this success, mobile phones still have challenges to overcome. These include the short battery life of the devices themselves, problems with a lack of network coverage, how to provide information to users on to a small screen without losing content, and trying to put alphabetical data into a device geared up for numerical entry.

There does, however, appear to be help at hand in the shape of 3G technology and the improved access to the internet and multi-media services it promises to offer. Discussion on the implications of 3G technology for mobile device and application development is dealt with in Chapter 8.

Personal digital assistants

Personal Digital Assistants, also known by some people as handheld PCs, were first developed with the aim of being personal electronic organisers. These devices typically contain information such as diary planners (very important for putting down information such as lecture times and appointments with supervisors), an address book and a 'to do' list. More recently, they have evolved to include some of the functionality offered by the traditional desk top PC such as word processing and they can also now provide you with access to the internet to allow you to browse the web and read your e-mail. This used to be dependent on you having cables that allowed you to connect up to the network wherever you were situated. However, PDAs now have wireless communication capabilities to allow you to transfer data (over short distances) between devices.

In terms of operating systems, there are a number available, such as Palm OS, Microsoft Windows Mobile and Symbian. However, there are some differences between these operating systems. For example, the Palm OS has been designed for PDAs which use stylus device input rather than keypad input. It is also possible to include a detachable keyboard for some of those PDAs that do not supply them. Does this seem counter-intuitive given the dynamic mobile environment in which you may be using your PDA?

Personal Digital Assistants, like mobile phones, also have their drawbacks. Battery life can be a problem as can memory capacity. For some people, relying on the handwriting capability of their PDA can be time consuming (not to mention frustrating) as they have to learn the art of

using the stylus in a way that allows the system to recognise accurately what they have written.

Laptops

Laptops basically have the same functionality as desktop PCs and today they are a common feature of many people's lives. For example, when making journeys by train, it is not unusual to see people tapping away on their laptops. It is also not unusual for students to use laptops whilst they are on campus at university. However, laptops are cumbersome to use in some mobile environments. They can be bulky and have to be carried around in a case. In addition, they also have short battery lives. Unlike a mobile phone or even a PDA device, if you suddenly get the urge to use your laptop, it is not simply a case of reaching into your pocket, pulling out your laptop, and switching it on. You may have to wait while the system or the application you want to use boots up. In addition, you may have to ask the people sitting at the table next to you to make space to allow you to place your laptop on the table and begin working.

Recently, there have been developments in the laptop market to try and overcome some of these technological and physical limitations. These developments have seen the launch of tablet PCs on to the market. There are two types of tablet PCs currently available. The first is known as the 'convertible tablet', which has a detachable keyboard (or in some cases a keyboard that can be folded away when not in use). The second type is known as a 'slate' tablet which does not have a keyboard and is a bit slimmer and lighter than its convertible counterpart. The slate tablet requires the user to use stylus input via a touch-sensitive screen. The convertible (as the name suggests) can also use stylus input. Both types of tablet are the same size and, like some PDAs, use wireless technology to allow the user to get access to the internet or other networks in the area they are currently located. How successful have tablets PCs been to date? That's a hard question to answer as the uptake of this technology currently appears to be quite slow. This may be due to the price (they can be more expensive than the traditional laptop) or because people are saving themselves for the development and widespread introduction of the hybrid device.

Hybrid devices

A hybrid mobile device is essentially a combination of a PDA and a mobile phone, its aim being to create a more effective mobile communication and

information device. These tend to fall into two categories. In the first category you have what is known as the ‘smart phone’. A good example of this type of device can be seen in Nokia’s Communicator 9500. This device offers users wireless connectivity, the ability to download e-mail and a qwerty keyboard. This device is known, apparently, within the industry as ‘the brick’. However, the fact that it has wireless connectivity is seen as a big bonus for people who want to e-mail or surf the net whilst they are on the go (all they need is a wireless network to connect to).

The second type of hybrid device is actually more similar to PDAs. A good example of this type of device is the ‘BlackBerry’. This device is dedicated to email and is very popular with businessmen who want to access their email whilst they are away from the office. It has a qwerty keyboard that is relatively easy to use. This is not the most aesthetically pleasing device to look at, but it does allow users to get access to their e-mails. Another example of this type of device can be seen in the ‘Palm Treo 600’. This runs on the Palm operating system and offers the user all the functionality of the PDA and has a mobile phone too. Unlike the Blackberry, the Treo has a touch-screen and digital camera. However, the qwerty keyboard that the Treo has is a bit smaller and more compact than the Blackberry.

Network accessibility

There have been a number of technological developments (such as general package services (GPS) and general package radio services (GPRS)) that have allowed the use of mobile devices in dynamic environments (e.g. in public places such as trains or in a café). In addition, Wireless local area networks (WLAN) have allowed laptop and PDA users to move about a building and still maintain a network connection. Most laptops are now equipped with WLAN cards, commonly known as WiFi (wireless fidelity), that allow users to connect their wireless enabled device to the internet once the user is within the range of a transmitter. These ‘hotspots’, as they are known, are sometimes marked by symbols on a wall in a street to alert other users of the opportunity for WiFi connection. Another new form of technology which you may have heard of, perhaps in relation to the hybrid devices mentioned above, is ‘Bluetooth’ – another wireless technology that allows users who are in close proximity to each other to exchange information between their respective devices. Bluetooth is essentially a microchip that is fitted into a device and it provides a short-range radio link between similarly