Ubiquitous Internet Environments

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INTRODUCTION

Let's remember the first films that started to show the broad public futuristic communication scenarios, where users were able to exchange almost any kind of information to communicate with anyone at any place and at any time, like Marc Daniels' "Star Trek" in the 1960s and James Cameron's "Terminator" in the 1970s, for example. The consequence of this was that impersonalized spaces (e.g., airports) (Auge, 1992) could easily become a personalized environment for working or leisure, according to the specific needs of each user.

These kinds of scenarios recently have been defined as ubiquitous communication environments. These environments are characterized by a system of interfaces that can be or fixed in allocated positions or portable (and/or wearable) devices. According to our experience with 2G technologies, we can foresee that the incoming 3G communication technologies will make sure, however, that the second typology of interfaces will become more and more protagonist in our daily lives. The reason is that portable and wearable devices represent a sort of prosthesis, and therefore, they reflect more than ever the definition of interface as an extension of the human body. When in 1973 Martin Cooper from Motorola patented an interface called Radio Telephone System (which can be defined as the first mobile phone), he probably didn't suspect the substantial repercussion of his invention in the human microenvironment and in its social sphere. The mobile phone, enabling an interpersonal communication that is time- and place-independent, has changed humans' habits and their way of making relationships (Rheingold, 1993). This system made possible a permanent and ubiquitous connection among users. At the same time, it has made users free to decide whether to be available or not in any moment and in any place they might be (Hunter, 2002).

This article is based on empirical work in the field with network operators (Vodafone) and handset manufacturers (Nokia) and research at the Politecnico di Milano University, the University of Lapland, and the University of Brighton. The intention is to give a practical approach to the design of interfaces in ubiquitous communication scenarios.

BACKGROUND

The methodologies and guidelines for the HCI design for handhelds initially were imported from the general theories of HCI for Web (Nielsen, 2000). Only after 1999 did this issue start to gain relevance as a research area. This can be reflected in the proliferation of focused conferences such as Mobile HCI started as a workshop in 1999 and has been explicitly treated in more holistic HCI conferences (e.g., CHI, HCI, Interact , Ubicomp, etc.). Unfortunately, the literature in this area is still scarce (Beaulieu, 2002; Bergman, 2000; Burkhardt, 2002; Hunter, 2002; Stanton, 2001; Weiss, 2002).

INTERNET MOBILE AND MOBILE COMMUNICATION

The Internet is related to a virtual space in which it is possible to interact with information. Mobile Internet, however, has represented an evolution of the concept of utopical (no real space) interaction to the concept of topical interaction, in which interaction (still with a virtual information space) happens in real places (Benedikt, 1991). This simultaneous presence of utopical and topical interaction makes necessary a direct relationship between both ambits (e.g., thanks to the GPS, what happens in real space must have an effect on the virtual one and vice versa). The communication now becomes space-sensitive or, better, context-sensitive.

Mobile communication is a broader concept than mobile Internet, as it embraces not only the connec-

tion to the net (intranet or extranet) but also voice and messaging (SMS, EMS, MMS) (Cereijo, 2001).

USAGE OF MOBILE COMMUNICATION

In the 1980s, the first generation (1G) of mobile communication systems revolutionized the TLC world, as users could carry a phone in their pocket. The 2G communication system and its new protocols to access the Internet, beyond just voice calls, provided users in mobility with a whole range of interactive services based on wireless data transmission.

Today, the market is characterized by different technologies—in America and Japan, the IS95 network based on CDMA (Code Division Multiple Access); in Europe, Asia, and Africa, the GSM (Global System for Mobile Communication) using TDMA (Time Division Multiple Access). Analysts foresee a relevant growth of mobile Internet users in the upcoming years—by 2005, more mobile phones will be connected to the Internet than PCs (Ovum, 3G Mobile, 2000).

Now we see the advent of 3G and 4G systems offering unprecedented bandwidth and speed connection up to 2 Mbps for data transmission with audio and video streaming capabilities directly on the phone. The variety and difference of the services offered are a challenge for today's service and application developers, and the battlefield is usability and effectiveness (Cereijo, 2002).

MULTI-ACCESS AND MULTI-CHANNEL CONVERGENCE

3G will be able to merge (at least) four media (Internet, SMS, TV, Smart-home). It is obvious that it will be crucial to offer an integrated system of new services with a perceived added value for the user in mobility. This integration also is called convergence and implies that all the information exchanged in the system (independently from the device of access) somehow must be centralized. The concept of convergence is related to that of the interoperability of the components of the same platform (e.g., the agenda, e-mail, block notes must share the same

information) and between different multilingual devices available. That means that a user's transaction with a certain interface (e.g., flight booking from an iTV setup box) also must appear in real time, if the user accesses the related site afterwards with a different interface (e.g., PC or Pocket PC). The problem of the convergence implies some other ones, such as the information must be optimized according to the physical and technical features of each interface (Cereijo, 2003).

One of the main consequences of 3G will be an enhanced interaction with information (companies and institutions), people (personal and group communication), the smart-house and the automated office. This context of ubiquitous communication (across mobile phones, iTV, palms, pocket PCs, PDAs, etc.) will have applications in domotics, videoconferencing, commerce, iTV, entertainment, learning, finance, medicine, and so forth (Burkhardt, 2002).

MULTI-CHANNEL IDENTITY

One of the challenges of 3G will be the design of the multi-channel identity. Each type of device has different technical and physical features that condition the design decisions (regarding architecture, navigation, contents, and graphics).

This requires a coordinated graphic and interaction design that takes these issues into account. At the same time, the peculiarities of each interface of the system (Figure 1) might make the achievement of desired design homogeneity difficult (from both the functional and visual point of view) (Bergman, 2000).

Figure 1.
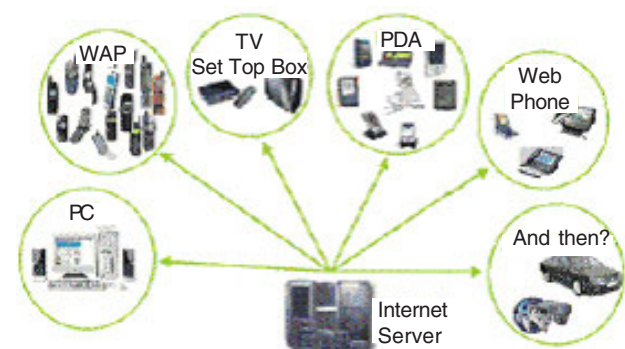
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