

## **Re-Conceptualizing the Mobile Phone – From Telephone to Collective Interfaces**

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### **Abstract**

This paper conceptualizes mobile phones as beyond two-way voice communication technologies, envisioning the mobile device as a social collective medium instead of a private personal technology. It addresses three central research questions: (1) What are the characteristics of mobile phones that differentiates them from traditional fixed phones? (2) What are some current uses of mobile interfaces that transform them into social collective media instead of private two-way voice communication devices? (3) What are the possible future developments of the mobile interface that these characteristics might lead to? Taking into consideration that new meanings for new interfaces are culturally and socially created, the paper addresses the emergence of social mobile networks created via mobile technologies. These networks emerge when cell phone use shifts from mobile telephone to a type of micro-computer, location aware device and internet connection interface.

**Keywords:** Cell phones; social networks; location awareness; collective interfaces; 4G; mobile technologies.

## Introduction

Since their inception cell phones have been regarded as mobile telephones. This is not surprising since cellular technology was created to allow many people to share the same radio frequency in adjacent cells in order to transmit voice – like the telephone. In the last 20 years since the first cell phone was commercially released, the devices have acquired other functions. Today's third generation (3G)<sup>1</sup> mobile phones include broadband Internet connection, multimedia messaging, text messaging, mobile pictures and more importantly, location awareness. Location-based applications create a new way of moving through the city and interacting with other users. In this new spatial perception, cell phones should be regarded as not only mobile telephones – devices enabled to transmit voice in two-way communication situations – but also as portable micro-computers embedded in public spaces. In the United States, as well as in other countries in Latin America, mobile phones continue to be used primarily for voice communication, as portable telephones. Under these circumstances, affirming that mobile devices are new interfaces through which communities are formed seems odd. However, Asian and Scandinavian countries show us that voice communication is one of the least used functions of the mobile device (Harper, Palen & Taylor 2005; Ito, Okabe & Matsuda, 2005; Rheingold 2002: 1-28). It is important to note that new meanings for new interfaces, in this case, cell phones, are developed mostly by youngsters (Ling & Yttri 2002), who are generally not influenced by previous uses of similar technologies – in this case, fixed telephones.

This paper conceptualizes cell phones as beyond two-way voice communication technologies, envisioning the mobile device as a social collective medium instead of a private personal technology. It addresses three central research questions: (1) What are the characteristics of mobile phones that differentiates them from traditional fixed phones? (2) What are some current uses of mobile interfaces that transform them into social collective media, instead of private two-way voice communication devices? (3) What are the possible future developments of the mobile interface that these characteristics might lead to?

To answer these questions, this paper is structured into three main parts. First, it explores three characteristics of mobile devices that distinguish them from telephone landlines and turns them into social collective technologies: pervasiveness, wearability and sociability. Second, it investigates some current uses of the mobile as a social interface: considering its relationship to public and private spaces, the creation of social networks via macro-coordination and the shared use of cell phones. Lastly, taking into consideration the aforementioned characteristics and current uses of the cell phone, the paper foresees some possible developments of the mobile interface, such as the creation of social networks, the use of location awareness, and the emergence of fourth generation (4G) technology.

This paper contributes to the ongoing explorations of the relationship between mobile technologies and society through examining three significant arenas: the development of new concepts and characteristics to analyze mobile devices; the re-shaping via interfaces of communication relationships and the spaces in which interactions take place; and the way cell phones strengthen users connections to physical space, a finding in opposition to some studies suggesting that cell phones withdraw users from the physical space in which they are (Gergen 2002; Plant 2001; Puro 2002).

## On Some Characteristics of the Mobile Interface

### Pervasiveness

In the mid 1990's, Mark Weiser (1996) at the Xerox Palo Alto Research Center (PARC) created the term *ubiquitous computing* to describe a third era in the history of computers. The first era he called mainframes, characterized by one computer being shared by lots of people. At that time, computers were run mostly by experts. The second phase, which spanned the last decade, was called the personal computing era, when person and machine stared uneasily at each other across the desktop. Each personal computer was meant to belong to one person. Next came ubiquitous computing, or the age of *calm technology*, when technology receded into the background of our lives and the computer-human relationship was characterized by many computers for one individual person. Thus, ubiquitous computing happens when computers are embedded in our daily lives and no longer part of a distant reality (Weiser 1996: [4]).

Weiser was a visionary. As early as 1987 he and his group at the Electronics and Imaging Laboratory at Xerox PARC started thinking about spreading computers universally throughout the environment. The idea was to make computers embedded in the physical world, albeit not perceivable. Weiser believed that the future of interface design was leading the world to an era of invisible interfaces:

A less-traveled path I call the 'invisible'; its highest ideal is to make a computer so embedded, so fitting, so natural, that we use it without even thinking about it" (Weiser 1996: [9]).

Weiser's (1996) concept of *ubiquitous computing* foresaw much of what today is named *pervasive computing*, such as sensors spread out in the environment, surveillance cameras, and mobile technologies.

Applying the concept of ubiquitous computing to cell phones means not only acknowledging the pervasiveness of the technology, but also viewing the mobile phone as a type of computer, which includes Internet connection, personal organizer, ability to send and receive emails and instant messages, besides helping community formation. Moreover, although mobile phones are not invisible – a required characteristic of Weiser and Brown's (1996) ubiquitous computers – their popularity in today's world transforms the device into the most pervasive technology in contemporary society. For instance, according to the International Telecommunications Union (ITU 2005), in countries such as Israel, the Czech Republic and Lithuania, the penetration rate of cell phone subscribers exceeds 100%, which means that some people have more than one mobile subscription.<sup>2</sup> Mobile phones can also be considered pervasive when compared to other telecommunication technologies: they are becoming more popular than TV sets (Rice & Katz 2003: 598); they outnumber landlines in all continents in the world (ITU 2005); they are the most common way to connect to the Internet in many countries (Doring & Gundolf 2005; Miyata et al. 2005; Rheingold, 2002); and among all mobile communication technologies, cell phones are the closest to the body (Fortunati 2002: 46; Fortunati 2005). The development of the mobile device shows that besides being more pervasive than the above-mentioned technologies, the cell phone, following a current tendency to media convergence, also incorporates many features of pre-existing technologies. For example, 3G cell phone subscribers are able to watch TV on their devices; in Japan most teenagers used their first *keitai*<sup>3</sup> to access the Internet, not their desktop PCs (Rheingold 2002: 6); and the proximity to the body transforms cell phones into wearable devices and fashion items.

There are two main consequences of the pervasiveness of cell phones. First, in countries where cell phone penetration rate is high,<sup>4</sup> and the majority of citizens have their own mobile device, we perceive the blooming of micro and macro-coordination acts. As demonstrated in the next section, acts of macro-coordination happen when mobile phones are used as social and collective technologies, since the cell phone is no longer used as a two-way technology but rather as a multicast interface, allowing coordination and mobilization among groups of people. Second, in countries where cell phones are still becoming pervasive, such as regions in Africa and in Latin America, cell phones are also used as social collective technologies but in a very different way. In this case, the ratio is not one cell phone per person, but many people to one cell phone. As addressed in the next section, mobile phone sharing is one characteristic of cell phone use in developing regions in the world (de Souza e Silva 2006; LaFraniere 2005).

### **Wearability**

Because they are used so close to the body (Fortunati 2002; 2005) mobile phones can also be regarded as wearable devices. Unlike wearable computers (Mann 1996) however, mobile technology devices are usually not meant to be worn. They are generally placed in pockets, belts or purses, becoming an indispensable accessory for everyday life. Yet Italian researcher Fortunati (2002: 46) asks whether mobile phones are really portable technologies: "If we look at the phenomenology of its use, its position on the surface of the body is both precarious and uncomfortable". She argues that the difficulty in finding an appropriate place for the cell phone on the body limits its wearability because "the tendency is to free it from its new place at the earliest opportunity and put it somewhere else" (Fortunati 2002: 47). For example, it is common to leave cell phones on tables in restaurants, bars or trains. The impact of this "placeless" cell phone could be computed by the London Transport's Lost Property Office, which reported that between April 200 and March 2001, mobiles replaced umbrellas as one of the most commonly returned lost item (Transport for London Lost Property Office 2001).

Studies on the design of cell phones try to make them more "wearable" or to adapt clothes to carry them. Fortunati (2002) mentions that Nokia "has teamed up with a European fashion house to create clothes specifically designed to incorporate mobile communication technologies" (p. 47). Likewise, IBM's wireless industry<sup>5</sup> explores ways to make technology wearable and pervasive. One of their earliest prototypes included a wearable "jewelry" cell phone. It consisted of a pair of earrings, a necklace, a watch and a ring that at first glance looked like ordinary jewelry. Reporter Tom Spring (2000) explained how it worked:

When you get a call, a tiny light starts blinking on your ring. The phone number of the person calling is displayed on the watch. You answer the phone by pressing a button on your watch. Next, you hear the call through your earring, which has a tiny speaker embedded in it. You then speak to the necklace, which has a tiny microphone inside and acts as a mouthpiece (Spring 2000: [3]).

Current research on fashion and technology tries to make new devices more embedded in the body and personalized, enabling information access anywhere, anytime.<sup>6</sup> In 2003 NTT DoCoMo, the main mobile communication company in Japan, announced the development of a new wearable cell phone: a wrist phone. Besides being a portable phone, the Wristomo becomes also a standard handset shape when opened. Like most watches, it is waterproof. Furthermore, it sends and receives e-mails, and is provided with a location-based service that informs the user about restaurants, weather and transportation, depending on the user's location. The Wristomo is not based on I-mode<sup>7</sup> 3G standard but, according to journalist

Anthony Newman (2003), "it is an important step in making Personal Digital Assistants (PDAs) and phones--and their connectivity--'ubiquitous' like watches" (Newman 2003: [1]).



**Figure 1.** NTT DoCoMo *Wristomo*

NTT DoCoMo Wristomo. © 2006, NTT DoCoMo, Inc. All Rights Reserved. Retrieved July 06, 2006, from [http://www.nttdocomo.com/presscenter/pressreleases/press/pressrelease.html?param\[no\]=228](http://www.nttdocomo.com/presscenter/pressreleases/press/pressrelease.html?param[no]=228)

Despite the popularity of hands-free devices in western countries, NTT DoCoMo (2003a) believes that the wearability of mobile phones is indeed connected to wrist watches. The company believes that Japanese people resist the use of earphone-microphones because they are reluctant to be seen as talking to themselves (NTT DoCoMo, 2003a). As a consequence, NTT DoCoMo developed a prototype called *FingerWhisper*, which consists of a handset that utilizes the human hand as part of the receiver. Worn on the wrist, the watch-like terminal converts voice to vibration through an actuator and channels this vibration through the bones to the tip of the index finger. By inserting the finger into the ear canal, the vibration can be heard as voice (Fukumoto & Tonomura 1999).



**Figure 2.** NTT DoCoMo *FingerWhisper*

NTT DoCoMo FingerWhisper. © 2006, NTT DoCoMo, Inc. All Rights Reserved. Retrieved July 06, 2006, from <http://www.nttdocomo.com/technologies/future/finger/index.html>

Although wrist watches have not become popular yet, the Japanese *keitai* is certainly not only a phone; it is also a personal item and part of the identity of many young teenagers. Plant (2001) comments that “in many parts of Pacific Asia, girls wear their mobiles as functional jewelry: in Bangkok they are carried in fur-edged plastic pouches worn as necklaces” (p. 44). Cell phone straps, initially popular in Japan, are nowadays part of the cell phone user’s personality in several countries, functioning as an identity element of the one who carries the phone. Ringtones play the same role.

While cell phones still cannot be regarded as “wearable” devices in the traditional sense (Mann 1996), they are often viewed as extensions of the body, particularly as extensions of one’s hands. Sadie Plant (2001: 23) showed that, except for the U.S. and Latin American countries where cell phones are called after the technology that produced them, in almost all parts of the world their names are connected to mobility, hands and portability. For example, in French the cell phone is called *le portable*. Finns name it *kännykkä* or *känny*, which refers to an extension of the hand. In Germany a cell phone is a *handy*. In Spanish, *le movil*. The shift from *cellular phone* to *mobile* or *handy* shows a transformation from a technological to a personal device. It represents the moment when the technology is no longer just a tool, but rather part of the self and part of one’s identity.

The ability to carry the technology closer to the body is a decisive factor when transforming cell phones into collective technologies. Wearability adds dynamism and speed in multicast communication exchange. For example, past acts of macro-coordination, such as public meetings and so on, have been made possible using email and instant messaging via the fixed Internet. However, more recent events such as the rally for the pro-impeachment of the Philippine President Joseph Estrada in 2001 (Rheingold 2002; as described in the next section) have been organized in a much swifter fashion, because citizens carrying their cell phones with them were able to receive rally information via text messages. If people had to go home and check their email in order to know what was going on, the protest against Estrada would not have happened so quickly.

### **Sociability**

Mobile phones acquire additional social meanings when they start to be used as more than two-way voice communication devices, by being shared among groups and used for social organization. Interestingly, early studies about cell phones analyzed the device as non-sociable media (Gergen 2002; Plant 2001; Puro 2002). Howard Rheingold (2002: xxii) observed that in trains and buses passengers prefer to talk to somebody who is physically absent than with other people who are in the same vehicle. Yet this is not altogether surprising, for since the emergence of the train as a transportation technology, communication inside the wagon has been awkward, leading to the habit of reading during the trip (Schilvelbusch 1986: 75). The short duration of a train trip does not provide the stimulus to start a conversation with somebody who is no more than a stranger – and probably will never be seen again. With further development of transportation technologies such as the automobile and the airplane, this situation did not change. However, cell phones have created new communication patterns, such as the enfolding of contexts.

According to N. Katherine Hayles (personal communication, November 19, 2002) the context is becoming enfolded, so that there is no longer a homogeneous context for a given spatial area but rather pockets of different contexts in it. For example, someone talking on a cell phone is part of the context of people who share the same spatial area, but she is also part of a distant context, because she is talking to someone who is spatially remote from her area. Hence there is a context that is created by the spatial proximity of people and inside it

another context that is created by the cell phone. This might have been a feature of other media as well, such as TV or wired telephones (Meyrowitz 1985; Moores 2004; Scannel 1996), however, the difference promoted by mobile technologies is precisely *the possibility of moving through space and the ability to be connected to other people while on the move*.

The first popular experience of enfolding contexts while moving through space was perceived with the Walkman in the early eighties (Hosokawa 1987), but these folded contexts were not connected to communication. The Walkman mixed the present context of the urban environment with a soundtrack that did not belong to it but was particular to the person who wore the device. Interestingly, many issues raised by the widespread use of the Walkman as a wearable technology can be applied to cell phones today. For example, Hosokawa (1987: 7) inquired whether or not using the Walkman implied a loss of contact with reality. While walking through space, the Walkman listener is in a world whose sounds do not correspond to the environment she sees. The ability to choose the soundtrack to the world also isolates the listener from contact to other people in the vicinity, and the physical environment becomes a background to the listener's thoughts. According to Hosokawa (1997):

The practical meaning of the Walkman is found in the distance that it creates between the reality and the real, the city and the urban, and mainly between the other and the self. The Walkman destroys the context of the city, and promptly places any incoherent situation in its context (p. 21).<sup>8</sup>

Due to its ability to isolate users from social interaction in public space, Walkman technology caused a lot of public debate (Licoppe & Heurtin 2002: 99). Similarly, although cell phones are seen as communication devices, often they have also been regarded as responsible for taking people out of the physical environment and isolating users. However, the differences between the Walkman and cell phone are many. First, mobile phones are generally used to interact with other people. Second, mobile phone interactions are unexpected, while the Walkman has a constant behavior while on. Lastly and more importantly, interaction with the cell phone is not limited to remote users, but can also include socialization with nearby peers. Kasesniemi and Rautiainen (2002: 182) observe that in Finland, where the use of Short Message Service (SMS) is frequent: "the recipient of the message is generally unaware of the number of people involved in composing the message and the time spent in formulating it", because the message is usually sent under the sender's name only. Kasesniemi and Rautiainen (2002) observed teenagers' behavior in buses and trains, while using their cell phones. Most of the time, the teens always had the device in their hands. When receiving a call, the conversation was frequently shared among the group. When writing an SMS, they also asked friends about the content and showed received messages to the group. This behavior challenges the common misconception that cell phones are private technologies which isolate users from their surroundings.

Similarly Weilenmann and Larsson showed that cell phones in Sweden are often shared to enable a whole group to talk to a remote person: "Instead of one person talking and 'shielding' her/himself from the group while doing it, everyone present involves themselves, and are allowed to involve themselves in the ongoing conversation" (2002: 98). The researchers noticed that the "shared use" of cell phones promoted communication and interaction among users who inhabited the same physical environment. They concluded, among other things, that:

...the remote communication, i.e., the phone calls they [teenagers] receive or make, as well as the SMS messages they receive or send, are accounted for in the ongoing local interaction. Teenagers thus share the communication they take part in with their co-present friends (Weilenmann and Larsson 2002: 95).

Thus the mobile becomes a collaborative resource for teenagers, rather than a private phone. As facilitated by the widespread use of SMS in Scandinavian countries, social communication promoted by cell phones is much more than merely two-way communication (Keyani & Farnham 2005; Kopomaa 2005; Ling, Julsrud & Yttri 2005).

Within this context, there are two opposing ways of looking at cell phones: one, following Klein, considers them as technologies that promote isolation (Gergen 2002; Plant 2001; Puro 2002). The other regards mobile phones as technologies that enhance communication (Keyani & Farnham 2005; Ling 2004; Rheingold 2002). In any case, what we learn about mobile communication technologies is that they simultaneously change our communication patterns and also transform our relationship to space. In this context, there is actually no point in discussing whether cell phones take us out of physical space or promote sociability among nearby users, because the space in which the communication happens is no longer physical or virtual; it is hybrid. A hybrid space encompasses both instances in one, enfolding contexts and connecting people who are distant *and* close. I define hybrid spaces as mobile spaces, created by the constant movement of users who carry portable devices continuously connected to the Internet, and to other users. The possibility of “always on” connection when one moves through the city transforms our experience of space by enfolding remote contexts inside the present context. This connection is related both to social interactions, as well as to connections to the information space, that is, the Internet (de Souza e Silva 2006: 262). The concept of hybrid spaces is relevant for understanding mobile devices as collective technologies because – differently from previously-defined concepts of mixed and augmented realities/spaces (Manovich, 2002; Milgram & Colquhoun Jr. 1999) – hybrid spaces are formed by a multicast communication of individuals who are moving simultaneously through physical and virtual spaces, using mobile technologies as connection interfaces.<sup>9</sup>

The pervasiveness, wearability and sociability of the cell phone are intrinsic characteristics and, as such, they contribute to some of the current uses of mobile interfaces as social collective technologies. These uses, which include the redefinition of public and private spaces, micro and macro-coordination and the shared use of cell phones, contribute, in turn, to the creation of hybrid spaces.

## **On the Current Uses of the Mobile Interface**

### **Mobility and Public / Private Spaces**

Gergen (2002: 230) splits communication interfaces into two categories: monological technologies and dialogic technologies. The first, which include TV, radio, and film, that is, broadcast mediums, bring the public into the private domain. The TV in a house functions as a window opened to the world. They insert outside voices into daily life circumstances, but there are few means by which one can respond to them. On the other hand, dialogic technologies include telephones and, consequently, cell phones. These interfaces, according to Gergen (2002), privatize spaces in the sense that the incoming outside voices are generally just available to one person at a time. Gergen (2002) also suggested that the emergence of communication technologies, like the telegraph in the past century, promoted an erosion of face-to-face communication. Interestingly, he stated that “when the telephone entered cultural life early in the twentieth century, it primarily served as an extension of face-to-face relations” (Gergen 2002: 236). The Internet can function both as a monological technology – when used for information access – as well as a dialogic medium – when used for two-way and multicast communication. Nevertheless, the Internet has rarely been

regarded as an extension of face-to-face communication. Due to the possibilities of reinventing the self and assuming “multiple identities”, the Internet has been seen more as a resource for hiding oneself behind the barrier of the interface rather than for extending “real” communication (Turkle 1995; Wertheim 1999). Cell phones, on the other hand, when having internet capabilities, may function as both a monological and a dialogic technology. Furthermore, when mobile phones are used for location-based mobile games (which are multiuser games played with mobile technologies equipped with Internet connection and location awareness) (Benford et al. 2003; Licoppe & Inada 2006), they work not only as dialogical technologies but also as multicast interfaces, allowing for multidirectional connection among many users. However, even simple text messages when used for many-to-many communication, may transform cell phones into multicast technologies (Glutz, Bertschi & Lock 2005; Harper, Palen & Taylor 2005), allowing the creation of social networks in hybrid spaces.

Accessing the Internet via mobile devices will change what we understand by the Internet. With the addition of location-awareness, the Web will be increasingly connected to places and progressively distant from the old-notion of a “non-place.” Moreover, the idea of “entering the Internet” is most likely to disappear, since 3G mobile phones are *always* connected. Ragano (2002: [8]), mentioned that *i-mode* developers avoided promoting the new service as ‘the Internet’ but instead offered it as a feature that was part of any *keitai*. Rheingold (2002) also observed that at the time they got their first *keitai*, most teenagers in Japan did not therefore access the Internet through their desktop PCs; consequently, none of them “thought of what they were doing as ‘using the Internet’” (p. 6).

Although cell phones are used differently in diverse parts of the world, they promote a blurring of borders between public and private spaces: enfolding the private within the public, bringing the public to the private, and creating private/public mobile islands. Especially among teenagers, mobile phones are not only used as instruments to build privacy, but also as enforcements of their social public identities. Plant (2001) argued that youngsters without cell phones “can feel – and really be – excluded from the social networks to which their friends belong” (p. 45). Ling and Yttri (2002: 147) observed that the most distinct profile of cell phone usage can actually be found in the youngest users, since they appropriate technology as an expressive medium for social purposes. Similarly, Ragano (2002: [22]) affirmed that many mobile Internet companies have studied children to understand the potential for new applications, since they are generally not influenced by previous meanings of existing similar interfaces and are therefore able to find unexpected meanings for new devices. Furthermore, Ling and Yttri (2002: 147) demonstrated that the most distinct profile of cell phone users can be observed among youngsters, since this is the segment of society that appropriates technology as an expressive medium for social purposes.

### **Mobility and Macro-Coordination**

Micro-coordination is the result of a series of short phone calls in order to establish appointments and to provide updates of real-time events (Ling 2004: 57-82) Macro-coordination, in turn, means the creation of mobile social networks via the use of cell phones as collective communication devices (de Souza e Silva 2006). These activities have been observed in countries such as Japan, Philippines, Finland, the USA and China (Castells et al 2004; Kasesniemi & Rautiainen 2002; Koskinen 2002; Rheingold 2002). One of the most popular cases of macro-coordination via mobile technologies occurred around the downfall of Philippine President Estrada in 2001. After some senators associated with the president succeeded in stopping the President’s impeachment process, opposition leaders started to

broadcast text messages in order to call citizens to gather. In 75 minutes after the failed impeachment, more than 20,000 people converged on EDSA, Manila's central thoroughfare:

The rapid assembly of the anti-Estrada crowd was a hallmark of early smart mob technology, and the millions of text messages exchanged by the demonstrators in 2001 was, by all accounts, a key to the crowd's esprit de corps (Rheingold 2002: 160).

The speed by which the social mobilization in the Philippines occurred is, as mentioned earlier, a consequence of the pervasiveness and wearability of cell phones. Were the protestors not carrying a cell phone at the time of the failed impeachment, none could have reached EDSA so quickly.

Similarly, a phenomenon named Flash Mobs has been observed in San Francisco, London, and Berlin. It consists of "dozens or even hundreds of people with cell phones who gather suddenly, perform some specific but innocuous act, and then promptly scatter" (Walker 2003: [2]). The "mobs" organize themselves via mobile phones and pagers. According to Walker, this social phenomenon has the ability to "make networks tangible" (2003: [4]).

Perhaps the strongest evidence of the collective use of mobile technologies and the construction of social networks is the emergence of hybrid reality (location-based mobile) games. Hybrid reality games (HRG) are multiuser games played with cell phones equipped with location awareness and Internet connection. HRG allow players to use the city space as a game board. *Botfighters* (2000-2006), officially released in Sweden in 2001 by *It's Alive* game producers, was the first commercially released location-based mobile game. It was designed as the traditional first-person shooter video game. However, in order to be played, users had to be moving through urban spaces. Depending on the relative position of each player in the city, users could then shoot other players with text messages, be targeted to receive a shot, and become involved in battles. The accuracy and success of each shot depended on the virtual weapons a player carried and her real distance to the target.<sup>10</sup>

A common characteristic of political demonstrations like the one in the Philippines, social events like Flash Mobs, and hybrid reality games like *Botfighters* (2000-2006) is that they are all social activities coordinated by the use of mobile phones. In such contexts, mobile devices are no longer used as private two-way voice communication devices, but rather as social collective communication technologies.

### **Mobility and the Shared Use of Cell Phones**

A last consequence of the pervasiveness and sociability of cell phones, is the sharing of the technology in developing regions in the world. Unlike the studies described by Kasesniemi and Rautiainen (2002) and Weilenmann and Larrson (2002), where each child generally owned a cell phone and where communication was mostly developed via SMS, in countries like Brazil and Venezuela and in some regions in Africa, one cell phone is used to connect whole communities.

For example, the slums (low income communities called "favelas") in Rio de Janeiro (Brazil), generally lack basic infrastructure such as electricity, water and gas. Therefore, the development of informal connections to these services is common, through which citizens acquire their use for free using clandestine wiring. Something similar happens with the telephone. Private landlines have never been widespread in regions of low income population. However, in these areas even pay phones are rare. Cell phones, in this context, fill in for the lack of private landlines and public phones through an informal appropriation of the technology. Frequently these cloned phones – used for free – are not private phones (as

generally cell phones are regarded), but become collective phones used by the community. These types of clandestine connections for telecommunications in the favelas are called “diretão”, which means roughly a straight call (which the user does not pay for) (de Souza e Silva *accepted for publication 2007*).

Similarly in Africa, in many places which do not have electricity and fixed telephone services, small businesses and private salespersons use cell phones as a means to connect their communities (LaFraniere 2005). Gilbert Nkuli, deputy managing director of Congo operations for Vodacom Group, one of Africa's biggest mobile operators, comments that in Congo: “One man uses it [a cell phone] as a public pay phone. Those who want to climb to his platform and use his phone pay him for the privilege” (LaFraniere 2005). Following this tendency to appropriate cell phones for business purposes, Montilla et al. (2003) explains that in Venezuela, many street vendors rent wireless minutes to pedestrians; an activity that is generally developed alongside a broken public phone. What is possible to observe in these cases is the transformation of a device that has been regarded as a “private” medium belonging to a single person, into a public phone and a collective device.

Looking at how cell phone usage has shifted today, from a private to a collective technology, might give some clues on how social use will interact with technological development in order to create new meanings for the mobile interface.

## **On the Developments of the Mobile Interface**

### **From Emergency Calls to Social Networks**

Benedikt (2000: 34) points out that until the 1940s the telephone, which is now taken for granted as a conversational device, had been envisioned merely as a different type of telegraph. Hence people only used telephones for *important* messages, and would hang up as soon as the essential message was relayed. Similarly, mobile phones have also been viewed as “urgency” devices. We have frequently heard that cell phones are just useful for emergencies or urgent messages, and that is why they should be carried around all the time. However, mobile phones not only evolved in the same direction as landline telephones – being used for long conversations – but are also used as a mix of pager (SMS), digital camera (camera-phone), video camera, personal organizer (PDA), micro-computer with mobile Internet (Wireless Application Protocol, WAP) and location awareness device.

As occurs with every new interface, it takes a while until users figure out the *meaning* of the new device. New meanings for new technologies are generally socially and culturally created. In the early days of cell phone development, for example, many people used to consider it a cordless traditional phone, thus keeping their mobiles at home, like a replacement or additional fixed phone. Fortunati wrote that European research conducted at Telecom Italia in 1996, “found that one owner out of five never used their mobile phone outside the four walls of the house” (2002: 47). Even if not considered a “replacement for the cordless phone” cell phones have been attributed with specific functions, in order to acquire meaning as a new interface. Considering mobile phones as “emergency” devices is one example. Talking in public on a cell phone was originally not considered polite and their use in public was justified only by answering extremely important or urgent calls.

The use of the mobile also differs depending on users' ages. Recent research (Ling & Yttri 2002: 147) shows that the oldest users (above 28) still focus on issues of safety and security. Middle-aged users (between 19 and 27) focus on the coordination potentials of the system, like micro-coordination and appointment calls. Finally, youngest users (between 14 and 18)

have the most distinct profile, using the cell phone as an expressive medium for social purposes. Therefore, younger users actually discover new meanings for the interface and explore new usage possibilities. Some examples already mentioned in this paper that point to the shift of the meaning of the cell phone as a telephone, are the shared cell phone use among teenagers in Finland and Sweden, and the use of mobile devices for macro-coordination.

### **From Telephone to Location Awareness Device**

Of all the features that mobile devices are acquiring, perhaps location awareness is the one which will consolidate the meaning of the mobile interface as different from a traditional telephone. The possibility of using location awareness technology defines the mobile phone as a device substantially different, not only from the traditional landline, but also from the personal computer. By determining the users' exact location on the globe, location awareness turns the cell phone into an interface capable of simultaneously mediating relationships among users, and between users and contiguous spaces: whereas a personal computer mediates only remote social relationships and a Global Positioning System (GPS) simply connects the user to the physical space, without providing social communication.

There are two different ways by which the cell phone can be aware of its position. One is accomplished by cellular positioning, which indicates the device's location through the triangulation of radio waves detected by the cell phone's position in relation to transmission towers. Another much more accurate way uses a GPS embedded in the phone. The system, connected to a constellation of satellites, gives the device's position with a small error margin.

Cellular positioning systems will potentially be applied to several daily activities. In 2005, the German company Siemens announced the release (due 2007) of software called *Digital Graffiti*, which works like a location aware post-it. Unlike a regular SMS, which is generally sent to one person, Digital Graffiti allows a text message to be sent to a specific place. The message is then received when users enter the space determined by the coordinates set up by the sender of the message. Possible uses for this software include, for example, sending a message to an area in a shopping mall to announce to passers-by who subscribe to the "shopping mode" that some stores are on sale, as well as tourism applications. The use of location-aware SMS might change the audio-tour concept, currently restricted to closed museum spaces, by allowing expansion to larger outdoor spaces. For instance, tourists visiting old ruins might receive site-specific historical information about monuments just by approaching them. Location-aware technology might also help mobile workers:

"Think about how small companies might team up on a job. Let's say you're a carpenter and you realize at short notice that you need to get a plumber. You could look at your phone and see who's available, someone in the region who doesn't have an appointment. Clearly, this is an application not for the PC, but for the cell phone", says Ulf Avrin, president of a joint venture between Ericsson and Microsoft (*DallasNews*, 20 Feb. 2001).

Location-based services are already popular in Japan. NTT DoCoMo (2003b) announced the first GPS mobile phone on March 2003. With the system – which is part of the i-mode standard – users can access information about the next coming bus, nearby restaurants, as well as routing information to help find specific locations. Furthermore, users can also find each other, as is the case of services like Ima-Hima,<sup>11</sup> a type of location aware instant messenger. ImaHima allows users to use the cell phone to connect to each other in physical spaces.

In the United States, although location-based services are not yet openly available to the public, this “capability is now required for all mobile operators to ensure that rescue workers can locate mobile users who are in trouble” (Stroud 2003). Any user who dials 911, the emergency number in the United States, has the position of their cell phone tracked by the triangulation of radio waves.

Mobile positioning is still viewed with caution in many countries, raising issues of privacy and control which have yet to be resolved, and therefore the service is not yet available. For example, in Denmark and Germany there are tough restrictions on location-based services for locating other people. Thus the Swedish game producer, *It's Alive*, had trouble launching the *Botfighters* (2000-2006) location-based mobile game in both countries. This attitude on the part of Denmark and Germany is based on the fear that many people have about being tracked down and losing their privacy and security. However, Hålling, *It's Alive* ex-CEO commented:

The accuracy of the location systems used are at best more or less several hundred meters in a city center. Would be hard to pinpoint your guy in a crowded street with that level of accuracy. On the country side accuracy may be in the order of kilometers. When accuracy is improved by using GPS receivers in the handsets, the game design will get adapted by introducing sufficient level of inaccuracy in order to protect personal integrity (Farber 2002)

The company also gives people warnings like “don't give out your name” or “don't be too accurate about your location”, in order to help preserve players' privacy and security, if they wish. In addition, similar to instant messaging software, people always have the option to block out people who get too friendly (Stroud 2003).

### **From the First to the Fourth Generation**

Although it is still not clear if location-awareness technology will be the killer application for mobile phones, it will certainly belong to the fourth generation of cellular systems. Mobile phone technology is categorized in generations. Around 20 years ago, first generation (1G) mobile phones were analog devices used exclusively for talking. The second generation (2G), characterized by digital systems, became popular in the early 1990's. In 2006, the Global System for Mobile Communication (GSM) is the standard 2G technology for the whole world. The addition of General Packet Radio Service (GPRS), as a layer over the GSM system, forms what is informally called 2.5G, and allows the connection to the Internet via packet switching technology. Third generation (3G) cell phones promise higher speed data transfer rates when connecting to the Internet, and the subsequent ability to stream video, send and receive pictures and video. However, although popular in some parts of the world such as Asian countries, 3G has not really “taken off” as predicted in most western countries. The failure of 3G is due to various reasons, including limited funding for new investments and technological development; few novel additional services; lack of knowledge and understanding of the services 3G can provide; and technical difficulties and limitations (Frattasi et al. 2006: 52). These issues have led to the development of 4G technology. 4G is expected to have a “highly eclectic structure, where many heterogeneous devices (from pen-phones to cars), networks (from short-range to digital broadcasting) and protocols, interact in a complex way to support increasing user demands” (Frattasi et al. 2006: 52). This means that 4G does not only provide –as was the case of 3G – an increase in the data transmission speed of mobile devices, but also provides a whole new way of connecting technologies. Generally speaking, mobile devices will use different technologies such as cellular systems, Wi-Fi and Bluetooth, depending on where they are in physical space, and the type of service

which is being accessed. Interfaces used may also vary including cell phones, smart phones, laptops and PDAs, which will all be able to communicate with each other.

Furthermore, data transmission speeds will exponentially increase, which will require the development of new interfaces for data display. Björn Krynlander, chief executive of UbiNetics a U.K.-based telecom technology company, suggested in a interview with the *Financial Times* (Baxter et al. 2003: 2) that some form of glasses or retina projection device might be the solution to display the outcome of a mobile Internet connection that will range from 100 megabytes (MB) to one gigabyte (GB) per second in 4G networks.<sup>12</sup> As a result, the visual component will acquire more importance in 4G mobile networks.

However, the shift to 4G will be slow. As Krynlander points out, the more pervasive a technology is the more users become used to it and the longer it will take to be replaced by a newer one (Baxter et al. 2003). Therefore, each mobile generation tends to have a longer life than its predecessor: "While 2G (GSM) has had a 10-12 year heyday, 3G will last 15-18 years, taking the arrival of 4G to 2019" (Baxter et al. 2003: 2).

## Conclusions

While we cannot see the future, the study and conceptualization of current characteristics and uses of mobile interfaces is necessary to project future developments in the area of mobile technologies. Pervasiveness, wearability and sociability are three characteristics of cell phones that help us to re-conceptualize the mobile as more than a two-way voice communication technology. Equally important, the current study briefly analyzed some current uses of the mobile interface as a social and collective technology when redefining public and private spaces and when used for collective actions of macro-coordination, as well as highlighting the shared use of cell phones. Although cell phones are already used as more than simply mobile telephones in places like Japan and Finland (Ito, Okabe & Matsuda 2005; Rheingold 2002), the development of new technologies such as location awareness and 4G will most likely reinforce this shift in the meaning of the mobile device: originally an emergency item, now a social network maker.

Rheingold (2002) described some aspects of mobile communities created by the use of mobile technology devices, such as Flash Mobs and the Thumb Tribes, in addition to the rally against President Estrada in Manila. Among other characteristics, mobile communities are networks in which the nodes are composed by individuals, rather than computers. Furthermore, mobile networks are, by definition, non-static; that is, its paths and nodes are constantly moving and being re-configured in function by means of a dynamic relationship between the nodes (cell phone users). Additionally, mobile networks take place in physical spaces, directly influencing and transforming the environment in which we live. Structurally, digital networks<sup>13</sup> are also configured in physical spaces. However, they connect computers as the nodes of the network, instead of people. Certainly people can use computers as interfaces to get into the network and therefore connect to other people, but digital network nodes are essentially static. Any change in a digital network reconfigures flows of information passing through it and rearranges a digital space which is constructed by connected computers, but does not reconfigure public spaces in real time. Conversely, mobile networks have the power to transform the physical environment that surrounds each user/node, even if the users do not share the same contiguous physical space. Connecting distant places, it creates a hybrid space that moves and reshapes itself while users are connected, generating foci of convergence and divergence depending on the users' actions / movements.

Mobility adds an important feature to telecommunication networks, because it allows coordination among the network nodes. Whereas using a static interface fixes the user in a specific place, mobile interfaces allow users to gather and disperse, bringing new meanings to tele- and close-communication

Sometimes, a simple technology such as SMS is enough for the creation of mobile networks, as seen in the acts of macro-coordination through SMS, such as the one in the Philippines and the Flash Mobs. However, the creation of mobile social networks is re-enforced and amplified when cell phones also know their position in physical spaces via location-awareness technology. In this context, the creation of mobile networks is possible when the mobile phone (1) becomes a pervasive and wearable technology, (2) is used as more than a mere “mobile telephone” and (3) is equipped with location awareness, which allows interaction in real time among users who walk through physical spaces, and between users and the space in which they are. Moreover, persistent Internet connection allows for interaction between users in physical and digital spaces.

Finally, we should be aware that the way in which we use specific interfaces never depends solely on technological innovations, but rather on the social use we make of them. It is imperative to highlight that interfaces are culturally defined: generally this means that the social meaning of an interface is not always developed when the technology is first created, but usually develops later when it is finally embedded in social practices. Take the case of the film camera and narrative films for instance (Murray 1997: 66), which were originally regarded as a mix of photography and theater (photo + play). Similarly, TV was formerly conceptualized as live radio with images; showing that many interfaces initially acquire their meanings from previous similar technologies.

The use of mobile phones follows this kind of progression. Originally regarded as mobile telephones, these devices can now be increasingly compared to micro-computers,<sup>14</sup> remote controls and collective social devices. Moreover, as discussed earlier, every shift in the meaning of an interface requires the re-conceptualization of the terminology used to describe it, and the type of social relationships and spaces it mediates. Because mobile devices create a more dynamic relationship with the Internet, thereby embedding it in everyday outdoor activities, we can no longer address the disconnection between physical and digital spaces. I name this new type of space, hybrid spaces.

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## Endnotes

<sup>1</sup> 3G (Third Generation Cellular Telephony) also stands for UMTS (Universal Mobile Telecommunication System). “UMTS allows many more applications to be introduced to a worldwide base of users and provides a vital link between today’s multiple GSM systems and IMT–2000. The new network also addresses the growing demand of mobile and Internet applications. UMTS increases transmission speed to 2 Mbps per mobile user and establishes a global roaming standard”. Source: International Engineering Consortium: <http://www.iec.org/online/tutorials/umts/topic01.html> Date Accessed: November 28, 2005.

<sup>2</sup> However, Ling (2004: 11) warns that these statistics ignore that some subscriptions are associated with function rather than individuals (like ambulances and so on). Also, there are many “dead” subscriptions and discarded handsets.

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<sup>3</sup> *Keitai* or *Ke-tai* is the word for cell phone in Japan, which roughly means “an extension of one’s hand”.

<sup>4</sup> The countries with more new cell phone additions in absolute numbers in 2005 were respectively, China (76 million), Russia (61 million), India (28 million) and Brazil (20.6 million) (Teleco 2006).

<sup>5</sup> <http://www-1.ibm.com/industries/wireless> Date Accessed: April 15, 2005.

<sup>6</sup> The Fashion and Technology show on Siggraph 2003 (San Diego) explored these issues, including an electric shock jacket from the Wearable Computing Group at the MIT, and special garments to accommodate cell phones.

<sup>7</sup> I-mode is a “data service launched in Japan by NTT DoCoMo as a layer over the cellular system PDC. It includes several multimedia services”. Teleco: <<http://www.teleco.com.br/glossario.asp?termo=i-mode> Date Accessed: May 17, 2004.

<sup>8</sup> Die praktische Bedeutung des Walkman besteht in der Distanz, die er zwischen der Wirklichkeit und dem Realen, der Stadt und dem Urbanen und insbesondere zwischen den Anderen und dem Ich entstehen lässt. Er zerstört den Kontext des bestehenden Textgefüges der Stadt und stellt gleichzeitig jedwede zusammenhanglose Situation in einen Kontext.

<sup>9</sup> For a deeper analysis of the concept of hybrid spaces, see De Souza e Silva, A. (2006) From Cyber to Hybrid: Mobile Technologies as Interfaces of Hybrid Spaces. *Space and Culture* Vol. 9, No. 9, pp. 261-278.

<sup>10</sup> An extensive list of existing location-based mobile games can be found at [http://www.induce.net/archives/locationbased\\_mobile\\_phone\\_games.php](http://www.induce.net/archives/locationbased_mobile_phone_games.php)

<sup>11</sup> ImaHima is the Japanese expression for "are you free now?" It is a mobile, location-integrated, community and instant messaging service allowing users to share their current personal status (location, activity, mood) publicly and privately with their buddies and send picture and instant messages to them" (1999-2004, ImaHima Inc) [http://www.imahima.com/ihtcorp2/container/imahima\\_community.php?stlang=EN](http://www.imahima.com/ihtcorp2/container/imahima_community.php?stlang=EN) Date Accessed: July 06, 2006.

<sup>12</sup> As a comparison, the faster modem connection today goes up to 56 kilobytes (KB) per second. 100 megabytes (MB) represents 100,000 kilobytes.

<sup>13</sup> Cellular networks are, technologically, digital networks. However, the term “digital network” is used in this work as a reference to the network shaped by personal computers which constituted, mainly, what was analyzed as cyberspace. Conversely, mobile networks are characterized by nomadic technology devices.

<sup>14</sup> A report from NTT DoCoMo (June 2004) states that today’s FOMA CPU processing speed is comparable to personal computers from eight years ago running Windows 95.

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