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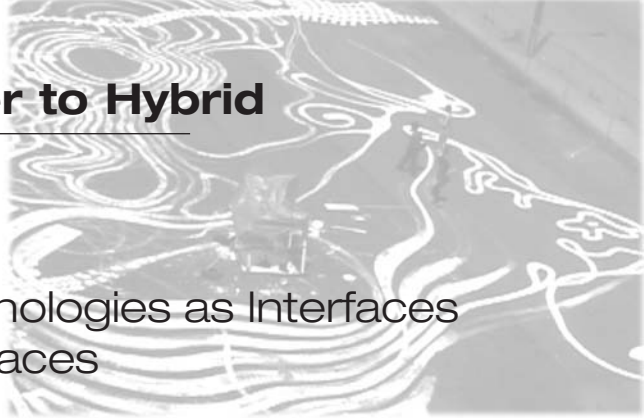
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# From Cyber to Hybrid

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## Mobile Technologies as Interfaces of Hybrid Spaces

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*Hybrid spaces arise when virtual communities (chats, multiuser domains, and massively multi-player online role-playing games), previously enacted in what was conceptualized as cyberspace, migrate to physical spaces because of the use of mobile technologies as interfaces. Mobile interfaces such as cell phones allow users to be constantly connected to the Internet while walking through urban spaces. This article defines hybrid spaces in the light of three major shifts in the interaction between mobile technology and spaces. First, it investigates how the use of mobile technologies as connection interfaces blurs the traditional borders between physical and digital spaces. Second, it argues that the shift from static to mobile interfaces brings social networks into physical spaces. Finally, it explores how urban spaces are reconfigured when they become hybrid spaces. For this purpose, hybrid spaces are conceptualized according to three distinct but overlapping trends: hybrid spaces as connected spaces, as mobile spaces, and as social spaces.*

*Keywords:* hybrid spaces; mobile technologies; cell phones; interfaces; mobility; connection; sociability

Interfaces define our perceptions of the space we inhabit, as well as the type of interaction with other people with whom we might connect. Interfaces are defined as communication mediators, representing information between two parts, making them meaningful to one another (Johnson, 1997; Lévy, 1993). The concept of a human-computer interface traditionally defines a communication relationship between a human and a machine. In this case, the role of the interface is to translate digital information from computers to humans to make it understandable to us. I propose a further conceptualization of “social interface,” which defines a digital device

that intermediates relationships between two or more users. Within this context, social interfaces not only reshape communication relationships but also reshape the space in which this interaction takes place. It is important to highlight that interfaces are also culturally defined, which means that generally, the social meaning of an interface is not always developed when the technology is first created but usually comes later, when it is finally embedded in social practices. Take the case of the film camera and narrative films (Murray, 1997, p. 66), which were originally regarded as a mix of photography and theater (photo + play). Similarly, TV was formerly conceptualized as a live radio with images, showing that many interfaces initially acquire their meanings from previous similar technologies.

The case of mobile phones follows this development. Formerly regarded as mobile telephones, these devices can now be increasingly compared to microcomputers,<sup>2</sup> remote controls, and collective social devices. Moreover, every shift in the meaning of an interface requires a reconceptualization of the type of social relationships and spaces it mediates. Because mobile devices create a more dynamic relationship with the Internet, embedding it in outdoor, everyday activities, we can no longer address the disconnection between physical and digital spaces. I name this new type of space hybrid space.

Hybrid spaces are mobile spaces, created by the constant movement of users who carry portable devices continuously connected to the Internet and to other users. A hybrid space is conceptually different from what has been termed mixed reality, augmented reality, augmented virtuality, or virtual reality, as discussed later in this article. The possibility of an “always-on” connection when one moves through a city transforms our experience of space by enfolding remote contexts inside the present context. This connection is related both to social interactions and to connections to the information space, that is, the Internet.

Mobile devices are all types of mobile technologies that promote remote and local multipersonal communication and connection to the Internet, allowing users to exchange information while moving through urban spaces. Today’s third-generation cellular telephony (3G)<sup>3</sup> cell phones include broadband Internet connection, multimedia messaging, text messaging, mobile pictures, and, more important, location awareness.<sup>4</sup> Location-based applications also create a new way of moving through a 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 microcomputers embedded in public spaces. In the United States, as well as in other countries in Latin America, cell phones continue to be used primarily for voice communication, as portable telephones. Likewise, 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 (Rheingold, 2002, pp. 1-28).

Although cell phones have substantially surpassed the number of PCs worldwide<sup>5</sup> and appear to be surpassing the popularity of TV sets (Rice & Katz, 2003, p. 598), it is not possible to define a worldwide cell phone culture, because cell phone use differs substantially from place to place depending on cultural and socioeconomic factors. Site-specific uses entail new social meaning for the cell phone as an interface. For the conceptualization of hybrid spaces, I explore mostly cell phone use in Asian countries, such as Japan, and in northern European countries, such as Sweden and Finland, because cell phones in these countries have been studied as collective communication

media (Brown, Green, & Harper, 2002; Katz & Aakhus, 2002; Koskinen, Kurvinen, & Turo-Kimo, 2002; Rheingold, 2002). Moreover, as Rheingold (2002, p. xii) noted, their devices possess both communication and computing capabilities and are therefore more than mobile telephones.

This article conceptualizes and defines hybrid spaces via three interconnected spatial analyses: connected spaces, mobile spaces, and social spaces. It addresses four central questions: How do mobile technologies reconfigure our perceptions of space via users who are always potentially connected to the Internet and to other users? How can cell phones be regarded as interfaces of hybrid spaces, promoting new types of social environments? What happens when virtual communities migrate from the fixed Internet to physical spaces interfaced by mobile technologies? and How do mobile technologies allow users to connect in new ways to people who share the same contiguous space via location awareness? To answer these questions, and to conceptualize this new spatial perception, three perspectives are addressed. First, I define hybrid reality as blurring the borders between digital and physical spaces and also in opposition to augmented and mixed realities, concepts that also claim the blurring of borders between the physical and the digital. Second, I analyze hybrid spaces as mobile spaces defined by mobile social networks and by the shift from static to mobile interfaces. Finally, I look at hybrid spaces as social spaces, analyzing the shift of communication spaces from cyberspace to hybrid spaces.

This essay contributes to the ongoing exploration of the relationship between mobile technologies and (physical/digital) spaces by examining three significant arenas: (a) the reshaping via interfaces of communication relationships and the spaces in which interactions take place; (b) the development of the concept of hybrid spaces to reconceptualize physical spaces by the connectivity of digital mobile media; and (c) the way cell phones strengthen users connections to physical space, a finding in opposition to current studies suggesting that cell phones withdraw users from the physical space in which they are (Gergen, 2002; Plant, 2001; Puro, 2002).

### Hybrid Spaces as Connected Spaces: Hybrid Reality Versus Virtual, Augmented, and Mixed Realities

Hybrid spaces merge the physical and the digital in a social environment created by the mobility of users connected via mobile technology devices. The emergence of portable communication technologies has contributed to the possibility of being always connected to digital spaces, literally “carrying” the Internet wherever we go.

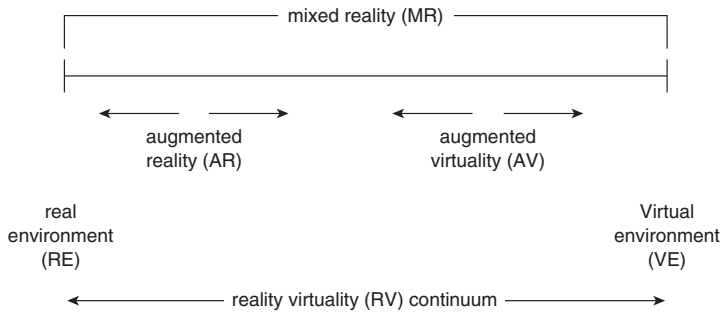
Because many mobile devices are constantly connected to the Internet, as is the case of the i-mode standard in Japan (NTT DoCoMo, 2006) users do not perceive physical and digital spaces as separate entities and do not have the feeling of “entering” the Internet, or being immersed in digital spaces, as was generally the case when one needed to sit down in front of a computer screen and dial a connection. According to Ragano (2002), i-mode developers avoided promoting the new service as “the Internet” but instead offered it as a feature that was part of any *keitai* (the Japanese word for “cell phone,” roughly “carried telephone”). Rheingold (2002) also noted that most teenagers in Japan did not access the Internet through desktop PCs when they got their first *keitai*; therefore, none of them “thought of what they were doing as ‘using the Internet’” (p. 6). With no previous connections to the concepts of immersion and virtual reality, mobile

digital spaces acquire a completely different meaning to this community of users: Instead of focusing on issues such as immersion and identity creation in virtual worlds, users are more likely to be concerned about how their *keitai* can help them in physical spaces, to find places and friends through location awareness, to buy train tickets, and to pay for groceries at the supermarket. Ling and Yttri (2002, p. 147) observed that the most distinct profile of cell phone use can actually be found in the youngest users, because they appropriate technology as an expressive medium for social purposes. Similarly, Ragano affirmed that many mobile Internet companies have studied children to understand the potential for new applications, because children are generally not influenced by previous meanings of existing similar interfaces and are therefore able to find unexpected meanings for new devices. Without the traditional distinction between physical and digital spaces, a hybrid space occurs when one no longer needs to go out of physical space to get in touch with digital environments. Therefore, the borders between digital and physical spaces, which were apparently clear with the fixed Internet, become blurred and no longer clearly distinguishable.

Existing concepts of augmented and mixed realities also address the interconnection between physical and digital spaces. However, a closer look at some definitions helps stress the distinctions. Milgram and Colquhoun (1999, pp. 5-28) pointed out that current literature on augmented reality defines it in three distinct ways, depending on the technology used. First, the traditional augmented reality is achieved by means of some kind of head-mounted or head-up display with see-through capabilities, in a way that the user can see the "real" world with overlaid graphical data. Broadening this concept, the second use of augmented reality refers to "any case in which an otherwise real environment is 'augmented' by means of virtual (computer graphic) objects" (p. 6). Milgram and Colquhoun gave the example of a photograph (a real image) on which computer-generated (virtual) images have been superimposed. Finally, they suggested a third class of augmented reality, which encompasses cases involving any mixture of real and virtual environments. Although the first and second trends can definitely be called augmented reality, a broader term must be defined for the third trend. Consequently, Milgram and Colquhoun created the term *mixed reality* to define situations in which it is not clear whether the primary environment is "real" or "virtual" or when there is no predominance of "real" or "virtual" elements in the environment (see Figure 1).

Milgram and Colquhoun (1999, p. 8) however, restricted their definition to graphic information; thus, elements from the real world inside modeled environments correspond to photographs, while elements from virtual realities inside unmodeled environments correspond to computer-generated images overlaid on photographs, for example. Their concepts of mixed and augmented realities take into consideration only the technology used to construct digital spaces but do not consider social and communication issues. Although their concepts do consider connections between physical and digital elements (which they named real and virtual), they are restricted to the overlay of graphic digital information on physical reality.

A different approach toward the definition of mixed reality was endorsed by Hiroshi Ishii (1999, p. 232), of the Tangible Media Group at the Massachusetts Institute of Technology's Media Lab. Ishii foresaw desktop computing changing into two major directions: onto our skin or bodies and onto the physical environments we inhabit. Whereas the first trend is connected to the definition of wearable computing, the second is related to ubiquitous computing. Ishii's group attempted to "bridge the gap between cyberspace and physical environment by making digital information (bits) tangible" (p. 233). In this sense, he dedicated considerable importance to material interfaces,



**Figure 1.** Definition of Mixed Reality Within the Context of the Real-Virtual Continuum

Source: Milgram and Colquhoun (1999, p. 7), reprinted with permission.

focusing on how to bring the “immaterial” bits of digital spaces into the physical world.

Ishii’s (1999) approach takes Milgram and Colquhoun (1999) definition one step further by emphasizing the physicality of digital interfaces. Ishii attempted to demonstrate that the interfaces through which we connect to digital spaces do change our

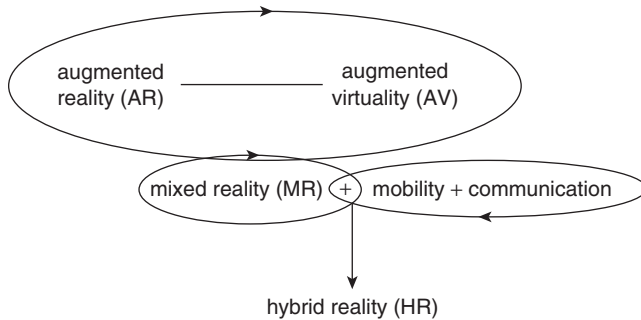
perceptions of digital information and reconfigure our perceptions of both physical and digital spaces. Moreover, by connecting mixed reality with wearable computers, Ishii emphasized the relevance of mobility in the blurring of borders between physical and digital spaces. However, like Milgram and Colquhoun, Ishii’s definition also does not include sociability and communication.

Following Ishii’s (1999) tendency to interconnect digital and physical worlds, Lev Manovich (2002, p. 1) recently stated that the 1990s were about the virtual and that it is quite possible that this decade of the 2000s will turn out to be about the physical. Manovich defined three types of applications that create an *augmented space*, a term he derived from *augmented reality* (p. 6). The first is video surveillance, which captures data from the physical environment and adds it to the digital network. The second, cellspace, inverts this situation by sending data to mobile users in physical space carrying Global Positioning System devices and cell phones. Similarly, but in a nonpersonalized approach, computer monitors and video displays in public places can present visible digital information to passersby. Manovich defined augmented space as a physical space transformed into a dataspace: “extracting data from it (surveillance) or augmenting it with data (cellspace, computer displays)” (p. 4). Therefore, the flows of information that previously occurred mainly in cyberspace can now be perceived as flowing into and out of physical space, blurring the borders between both.

Manovich (2002) developed an interesting approach to augmented spaces because his definition was not only restricted to technology but also intrinsically connected to artworks that take place in public spaces, including urban spaces in the definition of augmented reality. For example, Manovich described how Janet Cardiff’s audio walks overlay prerecorded sounds onto the city landscape while users walk in public spaces. However, communication and social interaction are still not required components for the construction of an augmented space.

From the merging of mixed reality and augmented spaces, mobility, and sociability arises a *hybrid reality*. It is exactly the mix of social practices that occur simultaneously in digital and in physical spaces, together with mobility, that creates the concept of hybrid reality (Figure 2).

A hybrid space, thus, is a conceptual space created by the merging of borders between physical and digital spaces, because of the use of mobile technologies as social devices. Nevertheless, a hybrid space is *not* constructed by technology. It is built by the connection of mobility and communication and materialized by social networks



**Figure 2.** Definition of Hybrid Reality

Source: de Souza e Silva (2004).

developed simultaneously in physical and digital spaces.

### Hybrid Spaces as Mobile Spaces

Mobile spaces are networked social spaces defined by the use of portable interfaces as the nodes of the network. The idea of mobile social networks and the use of cell phones as collective communication devices have

been observed in countries such as Japan, the Philippines, Finland, and China (Castells, 2000; Kasesniemi & Rautiainen, 2002; Koskinen, 2002; Rheingold, 2002). One of the most popular cases of macrocoordination 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 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, p. 160). Similarly, a phenomenon called flash mobs has been observed in San Francisco, London, and Berlin. Flash mobs are "dozens or even hundreds of people with cell phones who gather suddenly, perform some specific but innocuous act, and then promptly scatter" (Walker, 2003). The "mobs" organize themselves via mobile phones and pagers, and, according to Walker, the social phenomenon has the ability to "make networks tangible."

Perhaps the strongest evidence of bringing networked communities into hybrid spaces is the emergence of hybrid-reality (location-based mobile) games. Hybrid-reality games are multiuser games played with cell phones equipped with location awareness and Internet connections. Hybrid-reality games allow players to use city space as the game board. *Botfighters*, produced in Sweden in 2001 by It's Alive, was the first commercially released location-based mobile game. It was designed as a traditional first-person shooter video game. However, to play the game, users must move through urban spaces. Depending on the relative position of each player in the city, users can shoot other players with text messages, be targeted to receive shots, and get into battles. The accuracy and success of each shot depends on the virtual weapons a player carries and her or his real distance from a target. In this sense, hybrid-reality games are configured as massively multiplayer online role-playing games (MMORPGs)<sup>6</sup> played in physical (hybrid) spaces.<sup>7</sup>

A common characteristic of political demonstrations such as the one in the Philippines, social events such as flash mobs, and hybrid-reality games such as *Botfighters* is their ability to invert the traditional logic of the network, making it mobile and emphasizing its paths and connections to physical spaces instead of its nodes. A network, as defined by Rosenstiehl (1998), considers only specific connections and never looks at the paths. A network-man can play with alternate paths and "completely

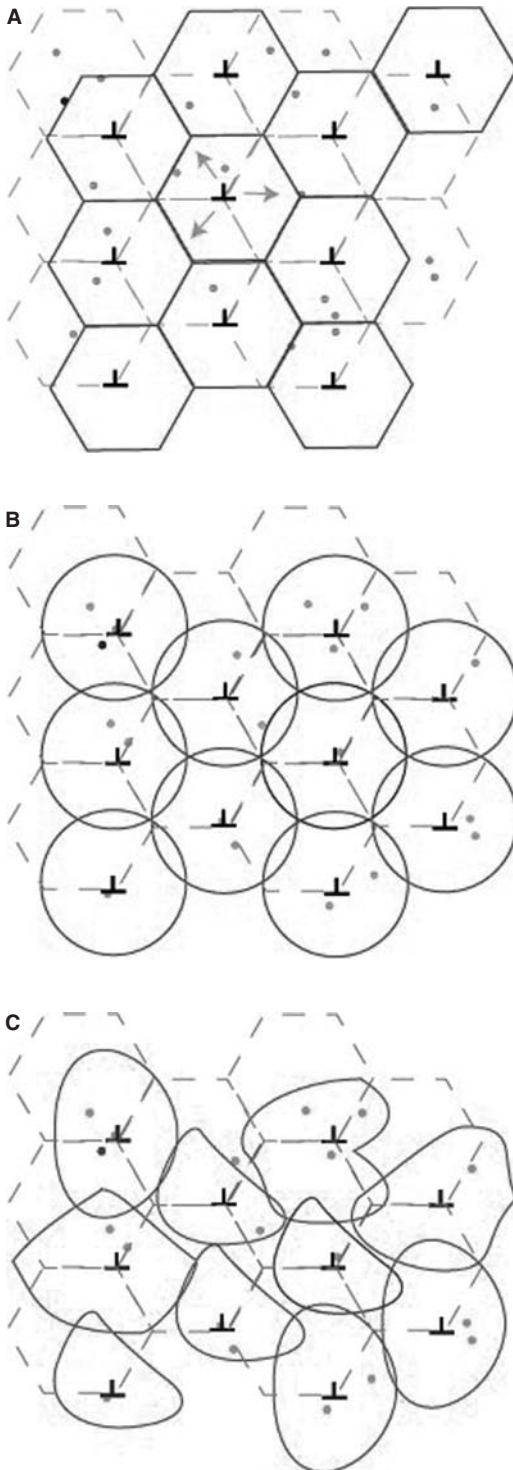
ignore the fact that a flight from Paris to Algeria flies over the Mediterranean” (Rosenstiehl, 1998, p. 229). Forgetting the space “in between” is a characteristic of networked systems. The Internet, as a computer network, and consequently cyberspace, as the information space that emerged from the connections of computers around the globe, have been frequently studied as the ultimate representation of the network concept, in which physical geography would not matter and anywhere in the globe would be “one click away” (Kelly, 1999). In this context, Serres (1994) applied the metaphor of a rich place (*riche lieu*) to the Web, as a single place that encompasses all others. This single place is oversized, equal to the planet, because it contains (virtually) everything. In this place, information, values, and data accumulate and circulate in the same single movement (Serres, 1994, p. 142). Although each Web site represents a node (a server) in the network, an Internet user generally has no clue about the path information travels between the time when a request is made and when the information is eventually shown on the client screen. Information travels by servers and routers, choosing the best path to follow, generally unknown to the common Internet user.

However, the popularity of mobile technologies and their uses as collective communication media remind us that networks are indeed spatial phenomena and that the space “in between” represented by the paths in fact matters. In contrast to the fixed Internet, on which servers and routers represent the fixed nodes of the digital network, in a mobile network, cell phones become these nodes, which are carried by users who wander through physical spaces. In this movement, not only the nodes of the network become mobile, but also the paths through which they move are critical to the configuration of the network.

Deleuze and Guattari (2002) offered a theoretical framework to understand the idea of mobile networks through the association of the nomad existence and the spatio-geographic aspect<sup>8</sup> of the war machine. They pointed out three characteristics of spatio-geographic nomadic movement. The first is related to points and paths of the nomadic network. Although a nomad is not ignorant of points, he or she focuses on paths, on the movement that happens between these points. In a nomadic network, the points are subordinated to the paths. Nomads also go from point to point, but as a mere consequence of their trajectories. “The life of the nomad is the intermezzo” (p. 380). Nomadic spaces are, following Deleuze and Guattari, smooth spaces, which means that the paths that determine nomadic movement are also mobile and easily “effaced and displaced with the trajectory” (p. 381). A nomad does not occupy predefined routes and paths: He or she constructs his or her own while moving through space. Mobile technology users take the nomadic concept one step further, because not only their paths are mobile but also the nodes. With the fixed Internet, and fixed landlines, computers and telephones were primarily connected to places. Conversely, cell phones represent movable connection points, accompanying their users’ movements in physical spaces.

A brief analysis of the cellular network model reinforces this connection between mobile networks and physical spaces. Figure 3A shows the classic representation of a cellular network. Cells are designed as hexagons adjacent to one another. Transmission towers occupy the corners of each hexagon, and users are represented by dots. Note that the cell is defined by a gray dashed line. The solid line defines the transmission range of each antenna, which transmits into the cells.<sup>9</sup> This representation, however, works for didactic purposes but does not correspond to reality. Ideally, the transmission range of each antenna defines a circle (see Figure 3B). In the physical world, however, each cell is influenced by weather conditions, by the number of users in each cell, and by the users’ movements within each cell, which turns them into ill-defined areas,





**Figure 3.** Real Representation of a Cellular Network, According to Raby, Suzuki, and Catterall (2000)  
Source: Author.

in constant movement (see Figure 3c). It is as if the cellular network stands as a layer over the physical space, attached to and being influenced by it.

Finally, a relevant perspective to define mobile spaces is the shift from static to mobile interfaces. This shift redefines the way we connect to the Internet and consequently our perceptions of digital spaces, as exemplified with the case of Japanese teenagers who do not see a disconnection between physical and digital spaces because their first experiences online were via cell phones. Static interfaces are defined as large-sized monitors, desktop computers, head mounted displays, that is, every type of interface that allows connection to digital spaces but does not allow a high degree of movement in physical space while connected. Conversely, mobile interfaces are defined as cell phones and personal digital assistants, that is, interfaces that allow connection to the Internet while moving through physical space.<sup>10</sup> These interfaces literally allow us to “carry the digital space” with us. As a consequence, mobility becomes part of the process of connecting to the digital and exploring hybrid spaces. The connection via mobile devices is fundamentally different from the connection through a desktop computer. First, desktop PCs are considered static interfaces, and therefore, the user needs to be stationary to “enter” the Internet. Second, because of the static interface, the experience of being online is generally a solitary one (Donath, 1997, p. 27). With portable technologies, users are connected while surrounded by other city dwellers. Mobile interfaces are used primarily inside social public spaces. Take the case of Japan. Kusahara (personal communication, January 16, 2003) suggested that the *keitai* is so popular in Japan because of the Japanese lifestyle: They live in a limited space, spending a long time using and waiting for public transportation. Therefore, a small device, which can fulfill the “in-between” space, becomes the ideal communication tool.<sup>11</sup>

As a consequence, the main question from the past decade regarding cyberspace, “How does one construct digital spaces?” can now be rephrased to “How is physical space reconceptualized by the connectivity of digital mobile media?” According to Townsend (2000), the mobile phone might “lead to a dramatic increase in the size of the city, not necessarily in a physical sense, but in terms of activity and productivity” (p. 14). Townsend noted that the technology for a high degree of mobility across the city has been around since the invention of the automobile (p. 10). However, the ability to coordinate social actions in real time occurred only with the advent of mobile communication technologies. Coordination implies not only microcoordination among individuals, but especially macrocoordination, as is the case with flash mobs, political manifestations, and location-based games.

The relationship between mobile interfaces and hybrid spaces is twofold. On one hand, the concept of digital space is no longer the same, because it is now merged with physical space. Embedding the Internet in everyday activities means that issues such as the creation of body and identity will be potentially replaced by issues such as location-based services and macrocoordination. On the other hand, mobile technology devices also influence the perception of urban spaces. According to N. Katherine Hayles (personal communication, November 19, 2002), space 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 he or she is also part of a distant context, because he or she is talking to someone who is spatially remote. 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. The notion of enfolded spaces is well exemplified by what Rheingold (2002) called “Tokyo thumb tribes,” Japanese teenagers who exchange huge numbers of text messages a day (about 80) and who barely use mobile phones as voice communication devices. Ito observed that the use of text messages has also changed their notion of presence: “As long as people participate in the shared communications of the group, they seem to be considered by others to be present” (quoted in Rheingold, 2002, p. 6). The enfolding of contexts (or the “doubling of space” as defined by Scannell, 1996), which allows users to feel as if they are in two places at once, might have been studied as a feature of other media as well, such as the radio, TV, or wired telephones (Meyrowitz, 1985; Scannell, 1996; Trow, 1981), but the difference with mobile technologies is precisely the possibility of moving through space while interacting with others who are both remote and in the same contiguous space via one’s relative location to other users. Within this context, concepts such as “enfolded” and “doubling” must be redefined, because they still allude to a division or separation of space. “Enfolded” is perhaps a better idea, because it alludes to some type of overlapping. However, the term *hybrid* defines a situation in which the borders between remote and contiguous contexts no longer can be clearly defined.

## Hybrid Spaces as Social Spaces

The Internet has been studied as a social immersive space in which users develop communities and construct worlds (Dibbell, 1999; Donath, 1997; Kim, 2000; Rheingold, 2002; Smith & Kollock, 1999). multiuser domains (MUDs); MUDs, object oriented;<sup>12</sup> and recently MMORPGs are examples of such online social spaces. Multiuser environments, constructed metaphorically as public social places, have attracted many people

willing to socialize with others outside their situated geographical boundaries. During the past decade, there has been a common belief that these “virtual” communities will indefinitely grow and that communication will increasingly migrate to cyberspace (Mitchell, 1995; Wertheim, 1999).<sup>13</sup> However, once mobile technologies become the interface to connect to the Internet, these communities are potentially brought into public urban spaces. Unlike traditional social public places, such as bars, squares, and automobiles, these new communities are reconfigured in hybrid spaces, because their users are simultaneously moving through physical space while connected in real time to other users via digital technology depending on their relative positions in physical space.

Location-based games, such as the previously mentioned *Botfighters*, and *Mogi* in Japan, have shown that location awareness is a key factor to bring virtual communities into hybrid spaces. *Mogi* is a hybrid reality game released in 2004, in which the main goal is to look for virtual creatures and objects spread around the city of Tokyo. Equipped with Java-enabled cell phones, users are able to see in their mobile screens a map of the city and the positions of nearby objects. Once users are within 300 meters of their targets, objects can be caught and uploaded into their cell phones. However, some creatures live in parks and go out only at night, so players must go to specific places at specific times to capture particular creatures. The multiuser function of the game comes from the need to exchange creatures and objects with other players to complete the collection. Once again, exchanges can be made only if the players are within a specific distance from one another in physical space. Another location-based application that brings the concept of instant messaging to urban spaces is the software imaHima, originally released in Japan in 2001. Similar to any instant messaging software, each user must agree to have his or her location tracked by imaHima. There is also the possibility of contacting a stranger whose profile matches the user’s request if he or she allows himself or herself to be contacted by an unknown person. However, whereas traditional instant messaging displays on computer screens simultaneously connected users, independent of their physical locations, imaHima connects people within a close radius in physical space.<sup>14</sup> There are currently 250,000 active imaHima users in Japan who access the imaHima service through i-mode and wireless application protocol phones (imaHima, 2005).

The popularity of these gadgets, devices, and applications in Japan provides evidence that cell phones are used not only to communicate with people who are distant but also to socialize with peers who are nearby, sharing the same physical space, even if they are not at eye-contact distance. Finding people to socialize in cyberspace has always been critical in multiuser environments on the fixed Internet. Mobile Internet users also look for people with whom to socialize. The difference, however, is that mobile networks help find people in public places. In the hybrid-spaces logic, cell phones do not take users out of physical space, as has been suggested by many scholars who have studied mobile devices as voice communication technologies (Gergen, 2002; Plant, 2001; Puro, 2002). Conversely, they strengthen users’ connections to the space they inhabit, because the connection to other users depends on their relative position in space. Therefore, games such as *Botfighters* and *Mogi* change the perception of physical spaces by transforming them into potential multiuser environments.

Once there is a shift from static to mobile interfaces, users are no longer required to sit in front of their computers, but rather, they move around in urban spaces—which are already social public spaces. The enfolding of digital and physical social spaces thus requires a redefinition of not only the concept of digital space but also our sense of distributed communities. How does the mobility of users influence the construction of social spaces?

Spaces have been defined in many different ways (Castells, 2000; de Certeau, 1984; Kelly, 1999; Lefebvre, 1991; Massey, 1995; Moores, 2004). Although a detailed analysis of this concept is outside the scope of this article, I would like to briefly point out some relevant notions for the construction of hybrid spaces as social spaces. Castells (2000) defines the space of flows as the dominant spatial logic of the network society. The space of flows is conceptualized as “a new spatial form characteristic of social practices that dominate and shape the network society” (p. 453). In this sense, “the space of flows is the material organization of time-sharing social practices that work through flows” (p. 442). Paraphrasing Castells, Stalder (2001) affirmed that “the space of flows is created by the real-time interaction of distributed social actors. The space is comprised of interactions and the material infrastructure that makes these interactions possible.” What is important to understand from this definition is that the space of flows is intrinsically a social space; according to Castells, space is the expression of society (p. 440). However, in the space of flows, the material infrastructure that makes these social interactions possible is in part composed of digital technologies and a physical network.

Moores (2004, p. 2-3) criticized Castells’s (2000) definition of places, arguing that places are not self-contained, because in any city, people maintain social relationships and connections that go beyond the physical boundaries of those specific places, transforming places in permeable localities (Moores, 2003; Meyrowitz, 1985; Massey, 1995). However, perhaps the major contribution of Castells is exactly to understand that following the logic of the space of flows, cities have become processes and networks rather than self-contained places, because the space of flows is not an immaterial fluid information space disconnected from physical spaces, but is rather embedded in urban structures (p. 417). Therefore, “the interaction between new information technology and current processes of social change does have a substantial impact on cities and space” (Castells, 2000, p. 429).

Perhaps what is missing from Castells’s (2000) definition, as noted by Moores (2004, p. 4), is the connection of the space of flows with the space of places, recognizing that both instances are not diametrically opposed forms and might be actually complementary, because the space of flows also includes social relationships within urban spaces. For the notion of hybrid space, thus, following Castells, I regard space as a concept produced and embedded by social practices, in which the support infrastructure is composed of a network of mobile technologies. Lefebvre’s (1991, p. 26) concept of social spaces defines social space as a social product rather than as preexisting physical spaces. In this sense, society constructs and defines space. Moreover, social spaces are not material things but rather a set of social relationships both between objects and objects and people (p. 83). The logic of hybrid spaces mediates this set of relationships of mobile technologies. The connections do not occur solely in physical space but rather in a new type of space that merges physical and digital. More than expanding the number of possible connections, like the telephone and the fixed Internet to a much greater extent, hybrid connections also change the perception of the physical space the users inhabit. For example, some *Botfighters* players report that they rediscovered the city of Stockholm while playing the game:

Eventually you start to take trips to places you wouldn’t go to otherwise. I found myself sitting on the Web trying to find a nice café in an unknown part of Stockholm so that me and my girlfriend could have a picnic and also destroy a certain bot. (“Mobile Killers,” 2001)

By transforming the city space into the game board—or by taking the game out of the computer screen—the familiar space of the city is transformed into a new and unexpected environment. It is as if the game creates an imaginary playful layer that merges with the city space, connecting people who previously did not know one another via mobile technologies according to their movement in physical spaces. Lehtonen and Mäenpää (1997) referred to this unpredictability in public spaces—also a characteristic of shopping—as *street sociability*, which is “the particular public form of sociality, of being at once both interested and yet indifferent and anonymous” (p. 156). While in the city, one cannot foresee whom one is going to meet or what is going to happen. It is exactly this unpredictability contained in gaming that makes it so exciting as an unexpected playful experience.<sup>15</sup>

Similarly, Niklas Stahre, a 24-year-old engineer who lives in Stockholm, was among the first enthusiastic *Botfighters* subscribers:

What appeals to me about mobile gaming is that you can interact with people while you are on the fly. You can play it whenever you want, wherever you want. You play against real people, and, with *Botfighters*, you have to move around to win an advantage. (Brown, 2000)

Finally, similar to Lefebvre (1991), Kelly (1999) stated that the true meaning of a space is related to its ability to absorb connections and relationships. Therefore, for Kelly, echoing Lefebvre and Castells (2000), space is a networked entity. Networks are spatial structures, and what guides their existence is the large number of connections embedded in them. A hybrid space is also a networked space, constituted by a mobile network of people and nomadic technologies that operate in noncontiguous physical spaces. Therefore, to integrate this space, a node (e.g., a person) does not need to share the same geographical space with another node of the mobile network. The hybrid space is created exactly by the merging of different and discontinuous places within one another.

Compared with the fixed Internet, mobile devices bring actions formerly performed in specific “private” places (homes or offices with desktop computers connected via cables to the network) to public urban spaces. Furthermore, these technologies create another perception of what it means to access the Internet. As discussed earlier, teenagers in Japan do not feel as if they are “entering the Internet” when they use their cell phones with *i-mode*, because the always-on connection is considered as a regular function of their cell phones (Ragano, 2002). The mobile Internet is becoming useful for actions that integrate the Web in physical spaces. For example, in Finland and Japan, it is possible to buy sodas in vending machines using mobile phones. Users are also able to purchase train and ski tickets with their mobile phones. Furthermore, the new *i-mode Felica*<sup>16</sup> allows users to use their cell phones as their wallets, to pay for groceries in the supermarket, and as their identification cards, to check in at airports. Finally, if a device has location awareness, it can be used to find restaurants, receive driving directions, and—to return to the idea of social space—to find friends who are nearby.

Since early on, cell phones have been studied as social collective technologies, in opposition to the general two-way communication of regular fixed phones. In addition to the already mentioned examples, such as the Tokyo thumb tribes of Japan, flash mobs, and the case of President Estrada in the Philippines, mobile phones have been studied as producers of social relationships via Short Message Service use in Finland (Kasesniemi & Rautiainen, 2002, p. 182). Location-based services such as *imaHima* and games such

as *Botfighters* and *Mogi* take the construction of hybrid social spaces one step further, because they connect users depending on their relative positions in urban spaces.

## Conclusions

The Internet undeniably opened our consciousness to the possibility of large-scale communities known as multiuser environments, which were not confined to the same physical place. Cell phones have been frequently studied as a means of two-way communication, whereby private spaces are created inside public spaces (Gergen, 2002; Plant, 2001; Puro, 2002). However, this article has focused on the use of mobile phones not as portable telephones but as microcomputers. Within this context, the comparison with the fixed Internet becomes more relevant than the comparison with traditional landlines.

The concept of cyberspace applied to the Internet was responsible first for our view of physical and digital as disconnected spaces, second for our emphasis on the nodes of the network instead of its spatial structure, and finally for the utopian view of a future in which social spaces would emerge mostly online. Mobile phones transgress this traditional relationship with the Internet because they are able to embed the Internet in public spaces. Because every shift of interface transforms not only the social relationships it mediates but also the spaces in which it is embedded, the notion of hybrid spaces encourages the redefinition of physical and digital spaces. For this reason, the concept of hybrid spaces arises to supply a gap opened when the Internet became mobile and when communities previously formed in cyberspace could be found in urban (hybrid) spaces.

Perhaps the most relevant feature of the cell phone in defining how mobile interfaces can influence our interaction with other users and with the space we inhabit is its location awareness. When a mobile interface knows where it is in physical space, it automatically acquires a different meaning from a fixed telephone and from a desktop computer, because one of its key functions becomes navigation in physical space. Internet capability added to location awareness allows users to have a unique relationship to physical space, as well as to the Internet. Changing our experience of space means not only interacting in new ways with other people but also redefining the space in which we live.

Although it is not possible to predict if specific local uses of mobile technologies in Asian and northern European countries will be observed in other countries in the world, some signs of how cell phones create hybrid spaces can already be felt also in Latin America. *Alien Revolt*, for example, was the first location-based mobile game commercially launched in Rio de Janeiro, Brazil, in May 2005. The game uses Java-enabled cell phones with location awareness to transform the city into a battlefield. Following much of the plot of *Botfighters*, the game's goal involves shooting other players who are within a specific radius in the city space. Moreover, as in *Mogi*, players are able to see and fight with virtual alien creatures that are nearby, represented on the radar of their cell phone screens. However, this is the first game of this type in Brazil, and it is not yet popular.<sup>17</sup> As in the United States, cell phones are still mostly used as two-way communication devices in most Latin American countries.

As a last example, I would like to mention an educational location-based mobile game developed by the Amsterdam Montessori School and the Waag Society. *Frequency 1550* was tested during February 2005 and used a part of the city of

Amsterdam as the game board. Students on the streets equipped with Java-enabled 3G location-aware cell phones needed to collaborate with remote online students to solve location-specific assignments about the medieval history of the city. Remote students were in classrooms and could track the position of their partners on the street via a map on their computer screens and communicate with them via audio. *Frequency 1550* demonstrates not only how mobile technologies can be used to bring educational activities outside the classroom but also how students can have different relationships with the cities in which they live. By overlaying a fictitious narrative about the Amsterdam of the past on the actual city space, students learned history and could connect to existing city landmarks in an unusual way. Moreover, they walked around in a space that was a mix of reality and imagination.

Foregrounding the pathway from the fixed Internet to hybrid spaces reterritorializes (a concept defined by Deleuze & Guattari, 2002, p. 380) multiuser environments, defined as social spaces that allow communication among people who do not share the same contiguous physical space. This idea can be easily transferred to physical space when we take a closer look, for example, at the development of location-based mobile games. Mobile communication technologies recreate urban spaces as multiuser environments. Because mobile devices create a more dynamic relationship to the Internet, embedding it in everyday activities that happen mostly outdoors, the idea of digital spaces as instances disconnected from physical spaces no longer applies.

The consequences of changes from the passage from cyber spaces to hybrid spaces are (a) the blurring of borders between physical and digital spaces, (b) the redefinition of the concept of the digital, (c) the redefinition of the concept of physical space to include hybrid environments, and (d) changes in sociability and communication patterns. Finally, the shift, driven by nomadic technologies, from cyber to hybrid calls our attention to the fact that the digital has never actually been separated from the physical and can be an essential element for promoting sociability and communication in urban spaces.

## Notes

1. This article comes from my PhD dissertation, *From Multiuser Environments as (Virtual) Spaces to (Hybrid) Spaces as Multiuser Environments: Nomadic Technology Devices and Hybrid Communication Places*, defended in the School of Communications at the Federal University of Rio de Janeiro, Brazil. Research for this article was supported by the Commission for Enhancement of Graduate Researchers (Brazil), a doctoral fellowship from the National Research Council (Brazil), and the Department of Design | Media Arts at the University of California, Los Angeles.

2. A report from NTT DoCoMo (2004) states that the speed of today's Freedom of Mobile Multimedia Access central processing units is comparable with that of personal computers from 8 years ago running Windows 95.

3. "3G" also refers to the Universal Mobile Telecommunications System (UMTS).

UMTS allows many more applications to be introduced to a worldwide base of users and provides a vital link between today's multiple GSM [Global System for Mobile Communications] systems and IMT-2000 [International Mobile Telecommunications-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. (International Engineering Consortium, 2005)

4. There are two different ways by which a cell phone can be aware of its position. One is cellular positioning, which indicates the device's location through the triangulation of radio waves detected by the cell phone in relation to transmission towers. Another, much more accurate, way uses Global Positioning System software embedded in the phone.

5. According to the International Telecommunication Union (2006), in 2004, there were 770,641,000 PCs and 1,751,940,000 cell phones.

6. MMORPGs are descendants of MUDs. However, whereas the early MUDs were purely textual, MMORPGs generally have graphical interfaces.

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

8. The other two aspects are the arithmetic or algebraic aspect and the affective aspect (p. 380).

9. More on cellular networks and wireless technologies can be found at <http://www.privateline.com>.

10. Note that all mobile interfaces are wireless, but this does not mean that all wireless interfaces are mobile. It is possible, for example, to connect a desktop computer and a printer via Bluetooth or Wi-Fi, but they do not support mobility.

11. Conversely, as noted by Ito,

Americans move between private nucleated homes, private transportation, and often private offices and cubicles as well, with quick forays in the car to shop occasionally (not daily grocery shopping as in Japan), and use of public space and restaurants has the sense of an optional excursion rather than a necessity. (quoted in Rheingold, 2002, p. 22)

12. MUDs, object oriented, are multiuser environments in which users can use programming languages to build objects in the virtual world.

13. Authors such as Hayles (1999) and Robins (2000) have criticized this position by emphasizing the connections between cyberspace and our physical world.

14. imaHima won the Prix Ars Electronica in the category Net Vision/Net Excellence in 2001.

15. Lehtonen and Mäenpää also suggested that

even though we emphasize unpredictability as the key to playful street sociability, it is important to note that this entertainment aspect of uncertainty relies on mutual trust between the "players." . . . If the implicit rules of street sociability are not followed, the aleatory elements, the feeling that "something unexpected might happen," starts to generate fear. (p. 161)

16. More information on the i-mode Felica is available at NTT DoCoMo's Web site (<http://www.nttdocomo.com>).

17. As of January 2006, *Alien Revolt* works on only two types of cell phones. Both cell phones and the prices for using the General Packet Radio Service Internet connection while playing the game are relatively expensive for the average user. Therefore, despite the massive advertisement campaign run by the operator Oi in Rio de Janeiro, the game never attracted more than 200 subscribers in a city of 13 million. A cheaper Short Message Service version is currently under development, according to the game's creators.

## References

- Brown, Amy. (2000, December 1). The games people play. Retrieved October 31, 2003, from <http://www.itsalive.com>
- Brown, B., Green, N., & Harper, R. (2002). *Wireless world: Social and interactional aspects of the mobile age*. London: Springer-Verlag.



- Castells, M. (2000). *The rise of the network society*. Oxford, UK: Blackwell.
- de Certeau, M. (1984). *The practice of everyday life*. Berkeley: University of California Press.
- Deleuze, G., & Guattari, F. (2002). 1227: Treatise on nomadology—The war machine. In G. Deleuze & F. Guattari (Eds.), *A thousand plateaus: Capitalism and schizophrenia* (pp. 351-423). Minneapolis: University of Minnesota Press.
- de Souza e Silva, A. (2004). *From multiuser environments as (virtual) spaces to (hybrid) spaces as multiuser environments: Nomadic technology devices and hybrid communication places*. Unpublished doctoral dissertation, Universidade Federal do Rio de Janeiro, Brazil.
- Dibbell, J. (1999). *My tiny life: Crime and passion in a virtual world*. New York: Owl.
- Donath, J. S. (1997). *Inhabiting the virtual city: The design of social environments for electronic communities*. Unpublished doctoral dissertation, Massachusetts Institute of Technology. Retrieved November 28, 2005, from <http://judith.www.media.mit.edu/Thesis/ThesisContents.html>
- Gergen, K. (2002). The challenge of absent presence. In J. Katz & M. Aakhus (Eds.), *Perpetual contact: Mobile communication, private talk, public performance* (pp. 227-241). Cambridge, UK: Cambridge University Press.
- Hayles, N. K. (1999). *How we became posthuman: Virtual bodies in cybernetics, literature, and informatics*. Chicago: University of Chicago Press.
- imaHima. (2005). imaHima. Available at [http://www.imahima.com/ihcorpv2/container/imahima\\_community.php?stlang=EN](http://www.imahima.com/ihcorpv2/container/imahima_community.php?stlang=EN)
- International Engineering Consortium. (2005). Universal Mobile Telecommunications System (UMTS) protocols and protocol testing. Retrieved November 28, 2005, from <http://www.iec.org/online/tutorials/umts/topic01.html>
- International Telecommunication Union. (2006). Free statistics. Retrieved November 25, 2005 from <http://www.itu.int/ITU-D/ict/statistics/>
- Ishii, H. (1999). Tangible bits: Coupling physicality and virtuality through tangible user interfaces. In Y. Ohta & H. Tamura (Eds.), *Mixed reality: Merging real and virtual worlds* (pp. 229-246). New York: Springer.
- Johnson, S. (1997). *Interface culture: How technology transforms the way we create and communicate*. San Francisco, CA: HarperEdge.
- Kasesniemi, E. L., & Rautiainen, P. (2002). Mobile culture of children and teenagers in Finland. In J. Katz & M. Aakhus (Eds.), *Perpetual contact: Mobile communication, private talk, public performance* (pp. 170-192). Cambridge, UK: Cambridge University Press.
- Katz, J., & Aakhus, M. A. (Eds.). (2002). *Perpetual contact: Mobile communication, private talk, public performance*. Cambridge, UK: Cambridge University Press.
- Kelly, K. (1999). *New rules for the new economy: 10 radical strategies for a connected world*. New York: Penguin.
- Kim, A. J. (2000). *Community building on the Web*. Berkeley, CA: Peachpit.
- Koskinen, I., Kurvinen, E., & Lehtonen, T. K. (2002). *Professional mobile image*. Helsinki, Finland: Edita Prima.
- Lefebvre, H. (1991). *The production of space* (D. Nicholson-Smith, Trans.). Malden, MA: Blackwell.
- Lehtonen, T. K., & Mäenpää, P. (1997). Shopping in the East Centre Mall. In P. Falk & C. Campbell (Eds.), *The shopping experience* (pp. 136-165). Thousand Oaks, CA: Sage.
- Lévy, P. (1993). *As tecnologias da inteligência: O futuro do pensamento na era da informática*. Rio de Janeiro, Brazil: Editora 34.
- Ling, R., & Yttri, B. (2002). Hyper-coordination via mobile phones in Norway. In J. Katz & M. Aakhus (Eds.), *Perpetual contact: Mobile communication, private talk, public performance* (pp. 139-169). Cambridge, UK: Cambridge University Press.
- Manovich, L. (2002). *The poetics of augmented space: Learning from Prada*. Retrieved August 16, 2003, from <http://www.manovich.net>
- Massey, D. (1995). The conceptualization of place. In D. Massey & P. Jess (Eds.), *A place in the world? Places, cultures and globalization* (pp. 45-77). Oxford, UK: Oxford University Press.

- Meyrowitz, J. (1985). *No sense of place: The impact of electronic media on social behavior*. New York: Oxford University Press.
- Milgram, P., & Colquhoun, H., Jr. (1999). A taxonomy of real and virtual world display integration. In Y. Ohta & H. Tamura (Eds.), *Mixed reality: Merging real and virtual worlds* (pp. 5-28). New York: Springer.
- Mitchell, W. J. (1995). *City of bits: Space, place, and the infobahn*. Cambridge, MA: MIT Press.
- Mobile killers. (2001, July 23). Retrieved October 31, 2003, from <http://www.itsalive.com>
- Moore, S. (2003). *Media, flows and places* (Media@LSE Electronic Working Papers Series, No. 6). Programme in Media and Communications, London School of Economics and Political Science. Retrieved November 27, 2005, from <http://www.lse.ac.uk/collections/media@lse/pdf/Media@lseEWP6.pdf>
- Moore, S. (2004). The doubling of place: Electronic media, time-space arrangements and social relationships. In N. Couldry & A. McCarthy (Eds.), *Mediaspace: Place, scale, and culture in a media age* (pp. 21-36). London: Routledge.
- Murray, J. (1997). *Hamlet on the Holodeck: The future of narrative in cyberspace*. New York: Free Press.
- NTT DoCoMo. (2004, June). *Size and weight reduction of progressively higher function mobile phones—Phones get smaller and lighter while taking on versatile features*. Retrieved July 5, 2004 from [http://www.nttdocomo.com/files/presscenter/34\\_No18\\_Doc.pdf](http://www.nttdocomo.com/files/presscenter/34_No18_Doc.pdf)
- NTT DoCoMo. (2006). *i-mode*. Available at <http://www.nttdocomo.com/services/imode/>
- Plant, Sadie. (2001). *On the mobile: The effects of mobile telephones on social and individual life*. Retrieved September 27, 2003, from [http://www.motorola.com/mot/doc/0/234\\_MotDoc.pdf](http://www.motorola.com/mot/doc/0/234_MotDoc.pdf)
- Puro, J. P. (2002) Finland: A mobile culture. In J. Katz & M. Aakhus (Eds.), *Perpetual contact: Mobile communication, private talk, public performance* (pp. 19-29). Cambridge, UK: Cambridge University Press.
- Raby, F., Suzuki, A., & Catterall, C. (2000). *Project #26765—Flirt: Flexible information and recreation for mobile users* (Project catalog). London: Royal College of Art.
- Ragano, D. (2002, March 5). Growing up in the age of the keitai. *The Feature*. Retrieved April 18, 2006, from [http://www.thefeaturearchives.com/topic/Archive/Growing\\_Up\\_in\\_the\\_Age\\_of\\_the\\_Keitai.html](http://www.thefeaturearchives.com/topic/Archive/Growing_Up_in_the_Age_of_the_Keitai.html)
- Rheingold, H. (2002). *Smart mobs: The next social revolution*. Cambridge, MA: Perseus.
- Rice, R., & Katz, J. (2003). Comparing Internet and mobile phone usage: Digital divides of usage, adoption, and dropouts. *Telecommunications Policy*, 27, 597-623.
- Robins, K. (2000). Cyberspace and the world we live in. In D. Bell & B. M. Kennedy (Eds.), *The cybercultures reader* (pp. 77-95). New York: Routledge.
- Rosenstiehl, P. (1988). Labirinto. In *Enciclopédia einaudi*, 13: *Lógica-combinatória* (pp. 247-273). Lisbon, Portugal: Imprensa Nacional/Casa da Moeda.
- Scannell, P. (1996). *Radio, television and modern life: A phenomenological approach*. Oxford, UK: Blackwell.
- Serres, M. (1994). *Atlas*. Lisbon, Portugal: Piaget.
- Smith, M. A., & Kollock, P. (1999). *Communities in cyberspace*. London: Routledge.
- Stalder, F. (2001). The space of flows: Notes on emergence, characteristics and possible impact on physical space. In *Proceedings of the 5th International PlaNet Congress*. Retrieved April 18, 2006, from [http://felix.openflows.org/html/space\\_of\\_flows.html](http://felix.openflows.org/html/space_of_flows.html)
- Townsend, A. M. (2000). Life in the real-time city: Mobile telephones and urban metabolism. *Journal of Urban Technology*, 7(2), 85-104.
- Trow, G. W. S. (1981). *Within the context of no context*. Boston: Little, Brown.
- Walker, Rob. (2003, August 24). We're all connected? *New York Times Magazine*. Retrieved September 27, 2003, from <http://www.nytimes.com/2003/08/24/magazine/24WWLN.html>
- Wertheim, M. (1999). *The pearly gates of cyberspace: A history of space from Dante to the Internet*. New York: Norton.

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