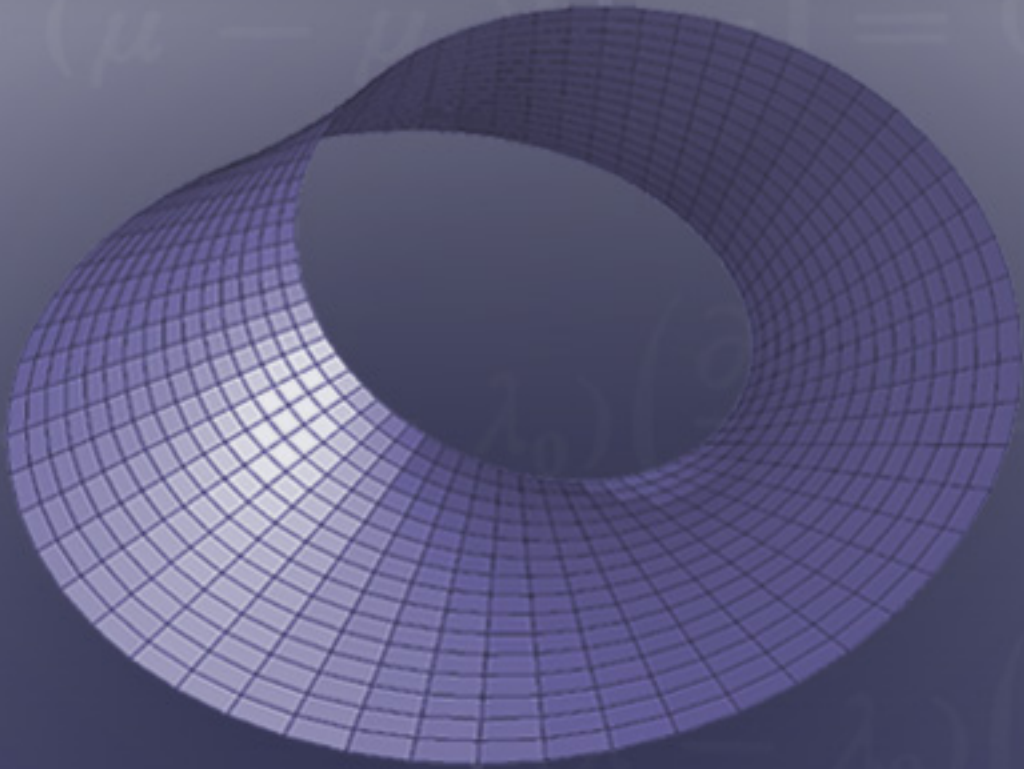# Towards spatializing the internet for creating a hybrid context for mediated communication

# Towards Spatializing the Internet for Creating a Hybrid Context for Mediated Communication

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## Abstract

Cities, as complex systems and contexts supporting communication are being re-ordered by technological systems and networks. Advances in mobile and wireless communication technologies (new mobile devices, GPS enabled phones etc.) and a series of location-based activities have begun to transform the potential for social relations taking place within the urban public space, as well as our perception of public spaces in general.

The paper discusses the technologies supporting such multi-user systems: interactive graphics interfaces for mobile devices and locative media. It also investigates the experience of interacting with such systems from a user perspective. The convergence of new mobile telecommunication networks, geographical positioning systems and graphical interfaces on mobile devices leads to new forms of interpersonal communication, in a hybrid context where the experience of urban space is augmented by multiple layers of information potentially accessible by all participating mobile users. Both these technological systems and the physical settings, within which they function, may become tools of social practice, arenas of sociability, experiential places of human interaction, while reality itself may be augmented through a communication system that allows users to dynamically merge the simulation experience with physical stimuli afforded by the physical world.

Mobile and locative technologies are therefore seen as supporting novel and revolutionary new ways of inhabiting urban space. Communication is tied to places and places to communication. With the emergence of locative and mobile communication systems, the city may again become a social arena.

*"Space is an expression of society. Since our societies are undergoing structural transformations, it is a reasonable hypothesis to suggest that new spatial forms and processes are currently emerging."*

(Castells, 1996, p. 410)

## 1. Introduction

This paper aims at investigating the emergence of new forms of multi-user graphical communication environments supported by the convergence of new mobile and locative media technologies and the impact that the implementation of these systems may have on mediated communication within the urban context. The paper focuses on such systems accessed via mainly interactive graphical interfaces and supported by different output devices (mobile phone screen, augmented reality displays etc.), which may ultimately afford a hybrid (synthetic & physical) spatial experience and a novel form of social interaction.

Cities, as complex systems and contexts supporting communication are being re-ordered by technological systems and networks. Advances in mobile and wireless communication technologies (new mobile devices, GPS[1] enabled phones etc.) and a series of location-based activities (games, socialising services, commercial applications and artworks) have begun to transform the potential for social relations taking place within the urban public space, as well as our perception of public spaces in general.

The paper discusses the technologies supporting such multi-user systems: interactive graphical interfaces for mobile devices and locative media. The paper also investigates the experience of interacting with such systems from a user's perspective. Finally, the impact of utilizing these systems for enriching social interaction and public life within the urban context is also discussed. Consequently, these emerging types of communication may lead to a new kind of agora, involving new forms of civic, cultural and political participation.

## 2. Interactive graphical interfaces as communication environments affording "telepresence"

Any investigation about the impact of new communication technologies on society as a whole and on its urban subspaces needs to point out its main intrinsic assumptions and limitations. Before discussing the social dimensions of multi-user environments for mobile and locative communication systems, this paper briefly refers to these systems' interactive graphical interfaces and their communicative function from a single-user perspective and

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[1] Geographical Positioning Systems (GPS)

investigates the experience perceived by each user, during interaction with the system. It is also important to clarify that this paper refers to multi-user interactive graphical interfaces that display some form of an environmental representation, within which all users of the system are concurrently being represented in real-time and which could comprise two-dimensional and/or three-dimensional visual content.

The aforementioned communication system embodies and integrates the functions of

- a *communication interface* (comprising physical media, codes, information and sensorimotor channels)
- a series of *transmission channels* and
- an *organizational infrastructure* (technical, business and regulatory).

Biocca & Delaney (1995) define a communication interface as the interaction of physical media, codes and information with the user's sensori-motor and perceptual systems. An important characteristic of this particular interface is its environmental character. The interface of other traditional electronic media (radio, TV) could also be considered as having an environmental character, in the sense that these media dominate the space within which they function as well as the mental space of humans who attend to them.

The human body, according to McLuhan, is the ancient system of interaction and the physical world is its content, while all media are "extensions of the senses". *Virtual reality*[2] (VR) considered as a medium, embodies the most advanced and revolutionary form of human-computer interface, since the design and development of VR systems primarily aims at extending the human senses, or to be more precise at extending the human sensorimotor channels of communication. Bricken (in Riva & Davide, 2001) suggests that the essence of VR is the inclusive relationship between the participant and the virtual environment, where direct experience of the immersive environment constitutes communication. An interactive graphical interface[3] however, does not necessarily afford such an immersive experience but still actively engages, at least up to an extend, some of the user's sensorimotor channels. In this sense, we could suggest that an interactive graphical interface is another advancement in a continuum of communication interface systems, like the radio, the TV or the telephone. An important characteristic of this particular interface is that it involves a certain engagement of the human sensorimotor channels into a vivid communication experience.

The concept of «information» is mostly used to denote *what* is transferred to a *single individual*, rather than what is exchanged between two or more individuals. Therefore, a

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[2] *Virtual reality* (VR) is the convergence of a series of technologies that supports a real-time interactive relation between a user of a computer system and three dimensional computer graphics environments, via visual, auditory and tactile sensory modalities (Meimaris, 1997). *Virtual Environments* (VEs) are the synthetic environments, the generation of which is supported by VR technology and which enable a user to interact with a computer system in a multisensory and intuitive manner.

[3] VR is also considered as an interactive graphical interface but an advanced form of it as such.

single-user interactive graphical interface may be defined more accurately as an information technology, rather than a communication technology (Schroeder, 1996). However, there is an important difference with other information technologies. The interfaces referred to in this paper provide a navigable and manipulable space, within which communication may take place. Following Biocca & Delaney's (1995) definition mentioned earlier, a single-user interactive graphical interface could be considered as a *«communication interface»*. Designing a communication interface implies the design of the way in which interaction occurs amongst physical media, codes and information on the one hand and the user's sensori-motor and perceptual systems on the other hand as well as the appropriate representation of this interaction.

When we experience the daily sense of our presence in the physical environment, we automatically produce a mental model of an external space from the stimuli that our sensory organs receive as input (Loomis, 1992). In this manner, the continuous, constant and coherent sense of presence is the basic state of our conscience, whereby the user attributes the source of the sensation to the physical environment. When a user experiences a computer mediated simulation environment, Lombard & Ditton (1997) suggest that his experience is traversed by a common idea: the "perceptual illusion of non-mediation" or what Minsky (Bracken & Lombard, 2004) has identified[4] as sense of *telepresence*. The experience of telepresence involves continuous and real-time responses of the perceptual, cognitive and affective processing systems of the user to objects and entities that are placed within his environment. The illusion of non-mediation then implies that the user fails, to an extent, to perceive or to identify the existence of a medium, as a cause of this experience and reacts as if this medium were not there (Lombard & Ditton, 1997). Steuer (1992: 78-80) defines telepresence as «the experience of presence in an environment through a medium of communication».

In the case of an interactive graphical "world" as an interface, the experience of telepresence is not as strong as in the case of a VR simulation "world". This is mainly due to the less immersive experience afforded by display devices and also due to the fact that the environment where interaction occurs may not necessarily be fully three-dimensional. Even in an interactive graphical interface however, we may consider that the user is somehow *tele-present* in the environmental context of interaction, irrespective of the immersiveness or the display quality of the experience.

Let us now consider graphical interfaces, which support participation of multiple users concurrently interacting and communicating within such an interface. These interfaces could, more appropriately than single-user graphical interface platforms, be characterised as

communication media. As Schroeder (1996) suggests, "the concept of a communication technology normally means that two or more people are involved and that the emphasis is given on the messages exchanged between them." Following Schroeder, the concepts of communication and medium should only be used in the framework of multi-user interactive graphics systems. Accordingly, Barnes (2001) suggests that a technological medium becomes a communication environment when it is transformed from a tool to a medium of symbolic interaction between people. The term "communication environment" appropriately characterises a "communication interface", which has environmental character[5]. The multi-user communication environments discussed here can be considered as one of the forms of computer-mediated communication. They function as systems of *interpersonal* but *mediated* communication[6], they can be primarily considered as tools for communication and interpersonal interaction or as socio-cognitive environments.

Therefore, a multi-user *interactive graphical interface* can be considered as a communication environment, within the context of which, communication amongst remotely located, networked individuals is mediated. Following McQuail's (1997:4) categorization of different levels of a communication process, this type of environment functions at two different levels:

1. **At a *personal level* (human-computer communication), information is transmitted to users in various forms. This information has been created either by the entity that designs, implements and possibly supports and controls the operation of the multi-user environment or is created by the participants themselves and is transmitted within the context of this environment, thus utilizing its functionality for communicating messages. Communication at this level may either be synchronous or asynchronous.**

2. **At an *interpersonal level* (human-computer-human communication), such a multi-user environment may function as the spatial context, which accommodates synchronous, interpersonal mediated communication of participants who are represented within this space by some form of graphical representation.**

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[4] Minsky has proposed the use of this term in the context of teleoperation technology.

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[5] Irrespective of whether it is fully 3D or 2D, it somehow visually and/or aurally represents an environment in a coherent manner.

[6] Gumpert & Cathcart (1986:30) used the term «interpersonal mediated communication» which they defined as «any human-to-human interaction where a medium intervenes in order to transcend space and time restrains».

## 3. Introducing mobility and multi-user access to interactive graphical communication environments

The contemporary urban environment in most developed countries of the world incorporates various kinds of representations of reality, communicated to citizens via various media and appropriate display systems[7]. These environments may also incorporate systems, which capture visual, auditory and other types of information regarding human activity[8] and consequently utilize this input to affect the process of generating electronic representations. We can therefore put forward the hypothesis (Charitos, 2005) that *the incorporation of such systems results in an electronic enhancement of our everyday urban environment and that our communication with these environments and with other citizens who exist and act within them is mediated by these systems.*

Biocca & Kim (1997) suggest a model that may support a better understanding and analysis of the experience afforded by these electronically enhanced mediated environments, from a user perspective. Following this model, the experience of humans interacting with such systems may fluctuate amongst three different states:

- *Presence in the physical world*: the most natural and non-mediated state of *"being here"*, where man attributes the source of his experience to the stimuli emanating from his physical surroundings.
- *Presence in an electronically mediated "virtual" environment*: this could be any synthetic experience with environmental qualities, which is generated by making use of one or more electronic communication media. When the perception of information from his non-mediated physical surroundings is somehow restricted and his interface with the media allows him to concentrate on the mediated information communicated to him, he may experience a sense of *"telepresence"*, as suggested earlier.
- *Presence in an imaginary environment*, which is dominated by internally generated mental images. In fact, a human may experience all three of these states at the same time but usually one of them prevails.

The sense of mediated presence within an environment may also be categorized into two different types of sense:

- *Physical sense of presence:* which the human experiences when physically existing within or close by a mediated or non-mediated environment

- *Social sense of presence:* which relates to the sense of proximity or co-existence with a virtual and possibly remotely located social entity.

Even though these two states are quite distinct, in some cases they may be mutually experienced, as in the cases of video-conferencing systems and collaborative multi-user VEs.

As suggested earlier, multi-user graphical communication environments redefine the meaning of sociality and mediated interpersonal communication. Voice and text-based mobile communication technologies have already restructured the relation between the spatial context where mediated communication occurs and urban space. Consequently, the novel phenomenon of *mobile sociability* is slowly transforming the potential for social relations in public spaces of the city. A series of new technological developments regarding wireless communication networks provide the opportunity for presenting interactive multimedia content via 2D & 3D graphics and video on mobile handsets, thus communicating more information and in a more pleasurable and engaging manner than text-based content. These developments afford the possibility of multisensory communication amongst remotely positioned and potentially mobile individuals via a graphical human-computer interface.

One very effective type of multimedia with a proven high ability to hold user attention span is the use of interactive 3D graphics on mobile interfaces. Interactive 3D graphics content adds to the sense of depth and the environmental character of the representation and also affords more possibilities for presenting information on the limited surface of a mobile device display. Moreover, the ability to interact and determine the course of the representation may significantly enhance the engagement of participants with the evolving action. This technology also allows for customization by the user, so that online personalities and animations can be created and send to others. These can also be connected to text based SMS messages, interpreting text and *emoticons*[9] within the text as expressions, actions or even lip-synching with voice mail (Beardow, 2002).

These facts have contributed to the gradual integration of interactive 3D graphics within the interface of mobile devices. One of these types of application are on-line 3D games, which have the potential for creating huge user on-line communities. There are no intrinsic limitations in multi-payer gaming in terms of maximum numbers of players or server loading. In an online game however, 3D content is distributed to users either playing at home (on a graphics PC) or on the road (on a mobile). It is significant to stress the fact that the introduction of 3D graphics in mobile devices implies the introduction of mobility into interacting with 3D interfaces and the possibility of both mobile and home users to participate concurrently in multi-user activities. One very good example of an artwork

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[7] For example: large size prints, video projections, wall paintings, TV closed circuits, etc.
[8] For example: video cameras, microphones, sensors, etc.

[9] Icons that express emotions.

affording such an experience is the revolutionary work of new media performance group *Blast Theory* titled "*Uncle Roy All Around You*"[10]

Mobility can also be introduced in mixed or augmented reality (AR) systems[11]. For example, a mobile AR game that takes place in the urban context may place the player in a hybrid kind of space simultaneously comprising the electronically mediated spatial context as well as his surrounding physical settings. At the 2003 "*Art & Communication*" festival in Riga, one guest demonstrated a system for playing the popular online video game Quake in urban space (Tuters, 2004), as opposed to behind a desktop computer. Developed at the University of South Australia, this wearable computer was mounted into backpack and the 3D space of the video game was projected over the real world landscape through a head-mounted display, while the two projected environments were coordinated with the help of GPS technology (Piekarski & Thomas, 2002).

## 4.  Location-Based Systems: introducing locativeness into mobile communication environments and the implications for the social experience within the urban context

New types of wireless communication networks enable the detection of user's position at all times via GPS or related technologies. This information is utilised by the system for updating the output displayed to the user, according to his dynamically changing location at all times. A new generation of location-based mobile games, which make good use of mobile and GPS technology, have already emerged in Japan and Scandinavia. These systems may be called "pervasive", in that they are always present and encompassing multi-user communication systems. Pervasive games are location-based, which means that the player's location is mapped onto his position within the game's spatial context. If for instance, you are attacked in the game you have the option to fight an opponent or to run for real. Technically, location-based features are enabled by a system that identifies location in real time, either as a part of a mobile network (cell ID, TA, E-OTD) or a GPS system[12]. The gradual convergence of mobile technologies, telecommunication networks, interactive multimedia and 3D interfaces on mobile devices with the ability to locate the user's position in the real world at

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[10] This work has been experienced by one of the authors during the Futuresonic conference in Manchester in 2004 and information about it and other related Blast Theory projects can be found at their web site: *www.blasttheory.com*

[11] A *mixed* or *augmented reality* system is a fully interactive system that displays to the user visual output, the source of which is a simultaneous integration of a synthetic 3D computer graphics world and real-time video footage of her surrounding environment.

[12] Based on information from a company's site ("It's Alive") that produces and distributes one of the first location-based games at: *www.itsalive.com*

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all times promises *a new form of communication*, that may expand and diversify the process of interpersonal communication and the very experience of everyday life afforded to individuals who use these systems.

In order to understand the social ramifications of locative communication media described above, it is important to investigate in detail, the impact that the kind of interpersonal communication they support has on our everyday experience within the urban environment. Souza e Silva (2004) was one of the first to suggest the importance of these interactive communication environments (for entertainment, collaboration, socialising, etc.) through which «virtual worlds immigrate from the internet to urban spaces». While the Internet allowed physical meeting places to «immigrate» to a "virtual" spatial context[13], the introduction of mobile location-based communication networks relates again the concept of a "meeting place" to the physical space of an urban environment[14]. Thus, social computing, which was previously restricted to the Internet is now brought back into the urban realm. Indeed, the emergence of locative-ness re-introduces the parameter of real location within the mediated communication activity, thus mapping the "virtual" mental space of communication to the physical space where the real bodies of communicating participants exist.

In location-based games, for example, the location of each player in the physical world, at each time, is very important[15]. In this manner, the virtual worlds of gaming are mapped onto the physical world and this hybrid spatial context becomes the arena of the game. It may then be suggested that urban physical space gains importance and is enriched with an essentially social quality: *locative media technologies pose location* not as a fixed parameter of design, but *as a practical condition of social encounters*, offering opportunities for action and interaction. These hybrid media, thus, bring back our attention to the social, cultural and intersubjectively constructed aspects that characterise urban space.

Ben Russell (2004), one of the founders of Locative Media Lab, clarifies: "Such systems enable a new generation of services and applications supporting new forms of communication amongst users of wireless devices. The Internet-enabled mobile device is essentially a bewildering array of applications that facilitate different forms of sociality and exchange. The new generation of Internet-enabled cell phones are a dense mesh of personal communications tools and systems: instant messaging, text messaging, picture messaging, blogging, moblogging, email, video telephony, voice calls and voice mail, web authoring and browsing, streaming media, geotagging, 3D massively multiplayer gaming, file sharing .....

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[13] The spatial context implied here is the mental space where communication in a text-based MUD or MOO occurs.

[14] The streets, the squares, the parks, the means of transport, the city as a whole.

[15] When, for example, the player approaches such a location his telephone notifies him of his whereabouts, while at the same time, his physical location is mapped onto the game's visual representation for all players to view.

Users can make and exchange chunks of media (in a range of forms) with individuals, targeted groups or the wider world... Whole new systems of media representation and exchange can be coded and emerge independent of research labs or corporations (e.g blogging)"

We should not underestimate the prospects of community-building through these systems. Sceptics still doubt whether technologically-mediated groupings and forms of communication come within the sphere of "real" community, however research regarding online environments has found that community can indeed be formed and social bonds maintained through electronic media. The emergence of community bonds between participants in fully-fledged or semi-electronic, hybrid places is multidimensional and rather complex, but it mostly has to do with fundamental processes such as emotional and mental "alignment" between participants, the creation of a "sense of common place" (*where we* are) and a "common definition of a situation" (*what we do*). In brief, community building takes place through practices, relations and concepts of togetherness and communality, through the dynamic interplay and negotiation of meanings by physically or mentally coexisting actors.

It is under this light, that locative media may be called systems of *situated, context-aware communication*. They are situated because they are rooted in the spatio-temporal nature of the physical world where interaction takes place[16]. They are situated because they give emphasis to the social actor and his intentions and mainly focus on the contextual constitution of individual and interpersonal events, such as various activities and conversations. By combining a visual interface with interpersonal communication flows, individuals are able to transform the "empty", "non-places" (Auge, 1995) of contemporary urban space into a perceivable and socially meaningful interaction space. Locative media are pervasive or ubiquitous environments, in that by functioning through the mobile phone they may surround the user, 24 hours a day, anywhere and anytime. In this sense, these systems are perfectly integrated in the space-time environment of users and connectivity itself becomes continuous, permanent, and synchronous to the movement of the individual user in the physical space.

Such situated communication systems may be contrasted with abstract communication systems. Abstract communication separates the message from the physical environment, whereas situated communication links them inextricably. Public space assumes new importance and new dimensions, through its «colonization» by mediation. New modes of

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[16] The concept of «social situatedness», although first put forward in the 1920s by the work of Lev Vygotsky, has recently received much attention in cognitive science and artificial intelligence research (Suchman, 1987). The notion of situatedness denotes that the development of individual intelligence requires a social and cultural embedding, that humans are situated agents and that human cognition is emergent from the interaction of the human with the environment.

social interaction may also emerge, such as gaming with strangers, dating etc. Technology can now be integrated into the everyday activities in the city. It is important to remember, however, that in situated mediated communication, we don't simply have to do with system users but with social actors who interact in a complex world and who participate in these electronic environments for pursuing various motives, aims and desires. Interpersonal communication is, after all, situational and situated by definition. Indeed, Stasser (1992) defined *interpersonal communication* as a process by which a group of social actors, in a given situation, negotiates the meaning of the various situations, which arise between them.

Evidently, this technology is essentially user-centric and as such, it demands new and more context-sensitive ways for conceptualizing, designing and studying it. The design of these systems should emphasise, even more than traditional user-centred human-computer interaction approaches, on supporting the actual needs of humans and groups as well as the social situations they find themselves in. Weiser's vision of *ubiquitous computing* (1991) and *ever-present connectivity* included the notion that technology should be designed to fit into our natural human environment. Accordingly, interfaces should closely model the way humans interact with the physical world and as has been earlier explained, this is one of the main principles of simulation technologies. Similarly, locative-based mediated environments bring human-computer communication and human-computer-human communication back into the context of our physical world, instead of expecting humans to adapt to the needs of a computer environment.

## 5. The future of mediated communication within the urban context

The social ramifications of communication media presented above are potentially significant. The convergence of new mobile telecommunication networks, geographical positioning systems and interactive 3D interfaces on mobile devices leads to new forms of interpersonal communication that may significantly alter the experience of urban space, as well as the relationship of the physical world with the technologically mediated environment experienced by individuals who use these systems. Both these technological systems and the physical settings, within which they function, may become tools of social practice, arenas of sociability, experiential places of human interaction, while reality itself may be augmented through a communication system that allows users to dynamically merge the simulation experience with physical stimuli afforded by the physical world.

However, it is important to clarify here, that these novel telecommunications technologies are not seen as *directly* causing urban change because of their *intrinsic* qualities or "logic" as space-transcending and unifying communication channels. Also, the proliferation of electronic spaces and networks is not merely seen as having *only* positive effects for urban

life. We all witness, daily, numerous events revealing how communication via mobile telephony may isolate individuals from the social context within which they function.[17]

While taking into account the fact that the dissemination of these technologies and communication practices may undermine urban life, this paper attempts to investigate possible reasons to support the view that it will also contribute to a regeneration of public space and of social life within it. Could mobile and location-based communication technologies afford highly mobile and individualistic 21st century city-dwellers the ability to connect to each other, to become more active and to recreate communities and bonds of socialization? A strong point can be made for the sociological importance of this technological hybridism. Public urban space in post-industrial highly urbanized societies is thought of as a space of anonymity, as a «non-space» (Auge, 1995). In this context, people pass by without forming relationships and without finding any meaning in this space other than merely moving from one point to the other, at a topological or geographical level.

Sociology and urban theory are full of narratives regarding the increasing de-localization, de-socialization or even disappearance of public space. If we consider a *place* as a *space* enriched with meaning, that harbours human interactions and relations, then the modern city of flows and rapid movement is a space without places, without sociality or sociability, without interpersonal density. Mobile networked connectivity and locativeness may potentially turn urban space into a place of meaningfulness and sociality again, as technology continues to penetrate what Oldenberg (1989) has described as "third places": the communal public spaces where people interact with friends or strangers. Similarly, Tuters (2004) suggests that mobile technology can transform the urban space of disconnected flows into a huge «peripatetic computer» of interpersonal contact that is a space full of potentially social places. This may lead to an electronically enhanced public space that can be enjoyed, as it regains life by becoming a setting for games, play, discovery, exploration, experimentation and socialization and as it aids city-dwellers who are virtually strangers to meet in public places and engage together in various activities.

Given that we are used to think of the *virtual* as the antithesis of the *physical* and consequently as non-real, the arrival of location-based virtual environments forces us to reconsider the relation between real and virtual spatial experience. The arrival of mobile and wireless technology creates a new way of connecting to the Internet, transforming anew the boundaries and the meaning of the virtual (technological) and the real (physical). The reversal

is obvious: while being wired to the Internet, we may exist in an immaterial world, disconnected from the geography of the material world while when connected via a mobile and locative system, the information sphere we access is related to geographical space.

The introduction of mobility into interacting with graphical communication environments, afforded concurrently to mobile and home users, creates very interesting prospects for such collaborative mediated experiences. With the aid of locative-based systems, space is being hybridised as the mediated spatial experience is mapped onto the physical urban environment, the virtual comes closer to the physical (De Souza e Silva, 2003), allowing for new kinds of collaborative interaction and collective gaming. Locative media are experiential applications of social networking; they are "worlded" technologies, belonging to our everyday heavily mediated world. Moreover, they are dynamic, since their stability is not given but is rather determined by the fortuitous and complex interrelations amongst humans, interactions, situations and places.

Understandably then, mobile and locative technologies are seen as supporting novel and revolutionary new ways of inhabiting urban space. Communication is tied to places and places to communication. With the emergence of locative and mobile communication systems, the city may again become a social arena. In the words of Thackara (2003) it may become a "post-spectacular city", where new technologies of information and communication are used for meaningful human interaction. These new technologies could transform not only the instrumental appropriation of urban space and its resources, but also its cultural, social and personal expressions because of its penetration in the social reproduction spheres of communicative actions.

## Bibliography

Auge, M. (1995) Non-places. Introduction to an anthropology of supermodernity. London: Verso.

Bardini, T. (1997) Bridging the Gulfs: From Hypertext to Cyberspace. Journal of Computer Mediated - Communication, 3(2), available at: http://www.ascusc.org/jcmc/vol3/issue2/bardini.html.

Barnes, S. (2001) *Online Connections*. New York: Hampton Press

Beardow, P. (2002) "Enabling Wireless Interactive 3D", article retrieved from the Superscape Plc. official web site at: *www.superscape.com* in June 2004.

Biocca, F., & Delaney, B. (1995) Immersive virtual reality technology, in F. Biocca, F. & Levy M. R. (Eds.) *Communication in the age of virtual reality*. Hillsdale, NJ: Lawrence Erlbaum Associates.

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[17] This paper adopts a Social Construction view of Technology, which instead of seeing technology as somewhat autonomous from society, tries to understand how technology and its use are socially (and politically) "constructed" through complex processes of institutional and personal interaction, whereby many different actors and agencies interplay over time.

Biocca, F. & Levy, M. (1995) "The vision of virtual reality", in Biocca, F. & Levy, M. (eds.) *Communication in the age of virtual reality.* Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Biocca, F. & Kim, T. (1997) "Telepresence via Television: Two dimensions of Telepresence May Have Different Connections to Memory and Persuasion". *Journal of Computer Mediated Communication,* Vol. 3 (2).

Bracken, C.C. & Lombard, M. (2004) "Social Presence and Children: Praise, Intrinsic Motivation, and Learning With Computers". *Journal of Communication,* March 2004, pp. 22-37.

Castells M. (1996) *The Rise of the Network Society.* Volume 1, Cambidge, Massachusetts: Blackwell.

Charitos, D. (2005) "Virtual Reality: A new kind of human-computer interface or a new communication medium ?". *Issues of Communication* (Zitimata Epikinonias), Vol. 2, Athens: Kastaniotis. (In Greek).

Ellis, S. R. (1991) "Nature and origins of virtual environments: a bibliographical essay". *Computing Systems in Engineering, 2*(4), 321-347.

Gumpert, G. & Cathcart, R. (1986) *Inter/Media: Interpersonal communication in a media world (3rd ed.).*

Lombard, M., & Ditton, T. (1997) «At the heart of it all: The concept of presence". *Journal of Computer-Mediated Communication,* Vol.3, (2). Available at: http://www.ascusc.org/jcmc/vol3/issue2/lombard.html

Loomis, J. M. (1992) "Distal attribution and presence". *Presence, Teleoperators, and Virtual Enviroments,* 1(1), pp. 113 – 118. Massachusetts: MIT Press.

McLellan, H. (1994) "Beam Me Up to My Avatar", *VR World,* March/April 94. Mecklermedia.

McQuail, D. (1997) *Mass Communication Theory: an Introduction.* Athens: Kastaniotis.

Meimaris, M. (1997) "Development, applications and perspectives of Virtual Reality", in *Proceedings of the International Conference "From Computer Graphics to Virtual Reality".* Athens: ATE Publications.

Oldenberg R. (1989) *The Great Good PlaceCafes, Coffee Shops, Bookstores, Bars, Hair Salons, and Other Hangouts at the Heart of a Community.* New York: Marlowe & Company

Palmer, M. T. (1995) Interpersonal communication and virtual reality: Mediating interpersonal relationships, in Biocca F. & Levy M.R. (eds.). *Communication in the age of virtual reality.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Piekarski, W. & Thomas, B. (2002) "ARQuake: The Outdoors Augmented Reality System". *Communications of the ACM,* vol. 45 (1), pp.36–38.

Riva, G. & Davide, F. (2001) "Virtual reality as communication tool: a socio-cognitive analysis", in *"Communications through virtual technology:Identity, Community and Technology in the Internet age".* Amsterdam: IOS Press,.

Russell B. (2004) *Locative media and social code.* Available at: http://www.receiver.vodafone.com/10/articles/pdf/10_05.pdf

Schroeder, R. (1996) *Possible worlds: The social dynamic of virtual reality technology.* Boulder, CO: Westview Press.

Souza e Silva, A. (2003) "Mobile Networks and Public Spaces – bringing multiuser environments into the physical space", in Ascott, R. (ed.) *Proceedings of the 2003 International Consciousness Reframed Conference.* CαiiA: University of Wales College. (in print)

Stasser, G. (1992) "Pooling of unshared information during group discussion", in Worchell S., Wood W, & Simpson J.A. (eds.) *Group processes and productivity.* Newbury Park, CA: Sage.

Steuer, J. S. (1992) Defining virtual reality: Dimensions determining telepresence. *Journal of Communication, 42*(4), pp. 73-93.

Suchman, L. (1987) *Plans and Situated Actions: The problem of human-machine communication.* Cambridge University Press.

Thackara, J. (2003) *"The post-spectacular city",* lecture at Creativity and the City Conference. Amsterdam, 25 September 2003.

Tuters, M. (2004) "The Locative Commons: Situating Location-Based Media in Urban Public Space", Electronic *Proceedings of the 2004 Futuresonic Conference,* Manchester.

Varela, F. J. (1992) "The reenchantement of the concrete", in J. Crary & S. Kwinter (eds) *Zone 6: Incorporations.* New York: Urzone.

Weiser, M. (1991) The Computer for the 21st Century, *Scientific American,* 265(3): 94-104, available at: http://www.ubiq.com/hypertext/weiser/SciAmDraft3.html