Technology and Metaphors: from Cyberspace to Ambient Intelligence

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Abstract

This article analyses the metaphorical imaginative discourse created around the various inventions and technical breakthroughs in the field of Information and Communication Technologies (ICTs), focussing namely in the Internet. By examining such technologies in their physical and metaphorical components, the article explains how the former has been perceived, understood and even shaped by the images and representations of the latter. The paper, by emphasizing the intrinsic cognitive, prospective and creative characteristics of metaphors, aims at demonstrating how the powerful, imaginative and self-enforcing metaphorical terminology (composed by visions and imagined concepts such as "giant brains", "information highways", "metaverse", "cyberspace" and "ambient intelligence") has been not only accompanying but also driving the incessant pace of technology, contributing to its social acceptance and implementation. In this way, the metaphorical terminology enterprise keeps re-inventing itself, providing continuously additional terms and notions to express the new realities that the emerging technological machinery is fabricating. Within the historical and the future evolution of the Internet (as well as of its metaphorical counterpart cyberspace) proposed by this article, the latter introduces the next technological scenario in the pipe-line – the so-called Ambient Intelligence (AmI) space – and announces the emergence of a new "wave" of metaphors and images that are being created to capture the prospective realities promised by the novel generation of ICTs.

Keywords: Information and Communication Technologies, Internet, Cyberspace, Ambient Intelligence.

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Introduction

The constant and incessant technological development which has been pacing the rhythm of the history of humanity since its very beginning, and which will certainly determine its evolution in the future, has produced an astronomical number of machines, devices, processes, mechanisms, inventions, apparatus, gadgets and tools. A substantial part of this machinery, along with its underlying technologies, has been devoted to the human need and desire to communicate and share information. The creation of the printing press, the telegraph,[1] the telephone, the radio and the television constitute important landmarks in the history of early modern communications technology, illustrating the continuous effort of mankind in developing better messaging devices, through which people could communicate across distances in an increasingly faster and easier way. Such novel possibilities for communicating, for exchanging messages

[1] For a colourful tale of the story of the telegraph's creation, see Standage, T. (1998). *The Victorian Internet: the remarkable story of the telegraph and the nineteenth century*s on-line pioneers*. New York: Walker and Co.(Standage, 1998)

and for distributing information, accompanied by new developments in computing technology, subsequently prepared and unleashed the greatest revolution in the human history of communication - the Internet.

Through the integration of a vast number of previous inventions and technologies,[2] the Internet constitutes a powerful medium for the instantaneous transmission of data and information, a giant physical machinery connecting the world, approximating people and cultures in an unprecedented way. Once this gigantic machine, while spreading its "tentacles" across the planet, began to work on a global scale, men and society changed. As a natural consequence of the enormous influence and impact that the Internet began exerting on the lives of its users, which number keeps growing exponentially, the human spirit, amazed by the functioning of this technology and enthusiast with all the wonders it promised to deliver in the future, embarked on creating a particular and self-enforcing metaphorical terminology to convey, rather imaginatively, the changes brought about by the Internet, and to describe, rather fantastically, the emergence of new (and often depicted in a "metaphysical" way) realms of human action. This particular period, accompanied by the launch of ground-breaking technologies, gave birth to a wide array of new terms, metaphors, visions, utopias and imagined concepts, such as *information highways*, *metaverse* and *cyberspace*.

There are, thus, two different dimensions according to which the emerging Information Communication Technologies (ICTs) can be analysed, the physical and the metaphorical one. Taking the example of the Internet, the former concerns and comprises all the physical elements which, grounded on a concrete material existence, forms the world-wide network of computers (pc's, wires, servers, protocols and software, among others), while the latter, the metaphorical one, constitutes the imaginary speech (extremely prolific in metaphors) created by the human mind to understand and represent the physical machinery. Such dual perspective divides the wide array of terms and notions spread throughout the studies of ICTs and digital communications into the mentioned two main dimensions. These two dimensions are, moreover, deeply inter-related and mutually influential, denoting a complex and intriguing relationship.

As technology keeps relentlessly developing, so does the metaphorical terminology enterprise, inventing additional terms and notions to express the new realities that innovative technological devices are continuously fabricating. The result has been an endless and complicated repository of terms, notions and designations, which, expressing either the technical or the metaphorical nature of the Internet, pervade the literature on ICTs. Moreover, these terms are frequently used interchangeably, often confusing, or even misleading, their readers. As such, one of the objectives of this article is, thus, to briefly analyze the main terms spread throughout the ICT literature, clustering them into their correspondent categories, i.e., either

[2] *Looking broadly at the Internet as a medium, the Internet is a combination of the capabilities of earlier media. As such its development owes a lot to previous innovations. Painstaking effort and risk taking by innovators of the telegraph, telephone, videophone, printing press, radio, and television had – one step at a time – conquered barriers to personal and mass communication of text, audio, and video.*" (Klotz, 2004, p. 13)

the physical or the metaphorical one. In this manner, terms as varied as Internet, World Wide Web, Information Highways, Virtual Worlds, Cyberspace, Metaverse and Virtual Reality will be duly framed and contextualized. This exercise, apart from its obvious explanatory purposes and clarifying aims, constitutes both a preamble and an introduction to the analysis of future technological scenarios, namely the forthcoming hybrid spaces such as the Ambient Intelligent Space (also called Ubiquitous Computing, Internet of Things or Disappearing Computer), - distinguishing these upcoming realities from its historical precedents – namely Internet and Cyberspace -, as well as explaining the evolution of the two latter into the former. The role of the metaphors and of the *imaginaire* created around the communication medium of the Internet will be given particular attention, as they express symbols and images which convey powerful ideas and messages, some of them with legal resonance and practical implications. [3] Furthermore, such analysis will subsequently (and hopefully) open up the floor for future studies and thorough examinations of the expectable role of metaphors in the conceptualization of future hybrid spaces and its eventual legal repercussions.

It is important to refer that the analysis of the terms in question are not tied to advanced technical knowledge and neither to any metaphysical doctrines or assumptions (including reflections on what is real or what is not), as both of them are deemed unnecessary for this matter and to the exercise in question. Instead, the analytical framework is constructed based on commonsense, i.e., on how every ordinary person generally understands, perceives and defines these terms. In this way, the methodology chosen is the one of commonsense ontology.

ICTs - Physical dimension

The physical dimension corresponds to an objective, technical and engineering look at the ICTs, describing its various structures as well as its operation mechanisms. It covers all the elements sharing a common technological nature (broadly defined as man-made) and, therefore, embodied into some kind of physical existence. The main term pertaining to this category is obviously the Internet,[4] the network of computer networks as it is usually defined,[5] or, in other words, the physical machinery and the underlying software through which information is stored, transmitted and accessed. Such group of terms comprise the various elements implicated in the Internet infrastructure, namely its architecture, protocols and software.

[3] In fact, from the choice and use of many of these metaphors different legal decisions and practical implications derive. (metaphors with legal resonance). In this sense, see article "The Future of" …

[4] Obviously, a multiplicity of other technologies and corresponding terms could be inserted in this category. Nevertheless, for the sake of simplicity and taking into account the topic of this essay, Internet is deemed as the most emblematic term representing this particular terminological category. Moreover, Internet – in itself –, and as already mentioned, comprises a vast number of previous other technologies.

[5] John Quaterman, in 1990, in the first reference book published on computer networks, used the term Matrix to define the Internet, describing the matrix "*as a worldwide metanetwork of connected computer networks and conferencing systems that provides unique services that are like, yet unlike, those of telephones, post offices, and libraries. It is a major tool in academic and industrial research in computer biology, social, and other sciences*" (Quarterman, 1990, p. xxiii).

The architecture of this meta-network is composed by a multiplicity of nodes connected through communication channels such as copper wires, fiber-optical cables and wireless connections. Pertaining to this architecture are also the end-points of these networks, i.e. computers and its various components (processors, modems, storage devices, etc), as well as input and output devices (monitors, keyboard, mice and others).[6] Covered by this physical category are also the operational elements of the Internet, namely the protocols, i.e., the set of rules that govern the communication between the nodes and through which interaction among the architectural elements take place. This complex infrastructure comprises also the software, which implement the protocols, making both the networks and the computing machines perform. In a nutshell, the physical category encompasses everything that ultimately can be related to either hardware or software involved in the functioning of the Internet.

Besides the devices and the mechanisms through which information is stored, processed and transmitted, this lexical cluster also covers the software through which information is displayed, visualized, accessed and navigated within, comprising terms such as hyperlinks and the World Wide Web (WWW or commonly referred to as the Web), Virtual Reality and Virtual Worlds. Regarding the World Wide Web, the latter can be defined as a collection of interconnected documents and other resources, linked by hyperlinks and URLs. In this way, the Web is a way to label, organize and connect information.[7] [8] Following the same reasoning, also the term Virtual Reality (Virtual Reality) can be included in the physical category. Accordingly, and behind the fantastic visions with which this technology is normally associated, VR consists of a medium conveying representations of three-dimensional spaces which, by themselves, are *simply pictures composed of bits and translated into analog images*.[9] Virtual Reality is, thus, just another kind of interface, another way of representing and displaying information. Along the same path, also the popularly known virtual worlds (such as "Second Life" or "World of Warcraft") pertain to the physical category. As such, these 3D digital environments, in the same manner as the World Wide Web or Virtual Reality, consist of a new kind of graphical interface, a novel way to display information. In the particular case of virtual worlds, the latter can be technically defined as shared, persistent, dynamic and representational computer-generated

[6] "*Input and output devices are necessary to make the results of computation accessible to humans…These devices all take real-world, analog information, which exists in forms which we may directly experience and typically understand, and turn that information into binary form.*" (Koepsell, 2000, pp. 81-82) In future technological scenarios (AmI), these input/output devices will grow in number and diversity, expanding from the current computer accessories to clothes, furniture, objects, etc.

[7] "*To organize this navigation, users needed a browser or navigator enabling them to select information and display it on the screen. This software, that its author called the World Wide Web, was ready in 1991. It included a HyperText Markup Language (HTML) for describing documents and another language called the HyperText Transfer Protocol (HTTP) for managing and transferring them. The documents were placed in servers with a Uniform Resource Locator (URL) address. Soon the World Wide Web software was circulating on the Internet*" (Flichy & ebrary Inc., 2007, p. 62).

[8] Other (and cumulative) examples of ways to label, organize and access information in the Internet can be found in the domain-name system and search engines.

[9] In this way, "*…bits, bytes, words, algorithms, and programs interact in such a way as to display pictures on screens or binocular googles.*" (Koepsell, 2000, p. 82)

environments which allow players to interact with each other and engage in a wide range of activities through the control and manipulation of a given character/interface - the avatar.[10]

In this way, the physical category here proposed encompasses not only the physical architecture – computers, wires and fibres– through which information circulates, but also the means through which information can be displayed, accessed and linked to one another. Under this analytical dimension, a massive amount of terms can be found, from fibres, routers, servers and computers to electromagnetic signs and pulses moving through wires or air. Such terminology includes, thus, all the terms that technically allow information to be processed, stored, displayed, transmitted and visualized.

As technology develops, and as ICTs keep spreading across the globe, merging its infrastructure with other telecommunication systems (cellular mobile networks, satellites, etc), allowing connectivity from virtually anywhere on earth, this physical machinery will gradually grow and expand. In the future, and as we shall see later on, this massive network of computers will radically change, transforming computers into microscopic devices, embedding them in everyday objects and pervading the environment. Nevertheless, and keeping our feet (for the time being) in the present, we shall now take a look at the different utopian visions and metaphors associated with Information Communication Technologies.

ICTs – Metaphorical Dimension

Why Metaphors matter?

Metaphors are important for facilitating symbolic representation and comprehensive understanding, for providing prospective hints on the expectable evolution of the object they are representing and for projecting and constructing their own autonomous realities. Putting it simpler, metaphors are inherently cognitive, prospective and creative.

Firstly, and taking into account that *"[t]he essence of metaphor is understanding and experiencing one kind of thing in terms of another"* (Lakoff & Johnson, 1980), the role of metaphors consists in shaping our understanding of reality, subsuming an external object to a mental framework, apprehending it in our knowledge and comprehension. In this matter, we are dealing with the human understanding and experience of a very complex external object – a massive communications network encompassing millions of persons and providing innumerable functions, services and activities: the Internet. Metaphors have, thus,

[10] Six main characteristics have been identified in Virtual Worlds: (1) shared space: the world allows many users to participate at once; (2) graphical user interface: the world depicts space visually, ranging in style from 2D "cartoon" imagery to more immersive 3D environments; (3) immediacy: interaction takes place in real time; (4) interactivity: the world allows users to alter, develop, build, or submit customized content; (5) persistence: the world's existence continues regardless of whether individual users are logged in; (6) socialization/community: the world allows and encourages the formation of in-world social groups like teams, guilds, clubs, cliques, housemates, neighbourhoods, etc. Book, B. *What is a Virtual World?* (available at: http://www.virtualworldsreview.com/).

the virtue of encouraging us to think beyond the surface meaning of the Internet, looking at it as something more than a complex machinery of cables, chips and servers. This means that the analysis of metaphors is important for cognitive reasons, consisting, in this particular case, in a way of examining how the Internet has been and should be understood, perceived, represented and symbolized. Mark Stefik, addressing the analysis of metaphors made by Lakoff & Johnson, emphasizes in his book "Internet Dreams"[11] the important cognitive task of metaphors, signalling also how influential and interventional they can be in conditioning human action:

> "*The metaphors we use constantly in our everyday language profoundly influence what we do, because they shape our understanding. George Lakoff and Mark Johnson say that metaphors are pervasive because they reflect how we think, perhaps embodying deeply unconscious archetypes of personality and vision. When we change the metaphors, therefore, we change how we think about things… The metaphors we use suggest ideas and we absorb them so quickly that we seldom even notice the metaphor, making much of our understanding completely unconscious.*" (Stefik, 1996, p. xvi)

Secondly, and since metaphors – as terms of comparison – can have the potential of influencing, affecting and changing the object compared, they are also important for prospective and future studies.[12] In this way, and by giving certain hints of how the future will look like, metaphors do not only consist of instruments allowing us to think of what the net is now, but also in what the net can become. In this sense, utopias "*are not set in another time or space; on the contrary, they are about the evolution/transformation of today's world*" (Flichy & ebrary Inc., 2007, p. 207). One paradigmatically example proving this anticipatory effect is the notion of "noosphere" authored by Teilhard de Chardin. Such concept, even though created long time before the Internet even existed, is commonly considered a metaphor of the world-wide network of computers. In this regard, "*Teilhard saw the Net coming more than half a century before it arrived*" (Kreisberg p.108, qtd. in Flichy & ebrary Inc., 2007, p. 111). According to that view, "*the process of integration of the universe that Teilhard de Chardin saw happening, with the emergence of an informational membrane enveloping our planet and unifying the human mind (the "noosphere"), was a perfect description of the Internet*" (Flichy & ebrary Inc., 2007, p. 111). Taking into account this particular example, it seems impossible not to agree with Mark Stefik, who appropriately states that "[*b*]ecause *metaphors can guide our imagination about a new invention, they influence what it can be even before it exists*" (Stefik, 1996, p. xvi).

[11] Stefik identifies four main metaphors associated with the Internet, which correspond to four ancient cultural archetypes that have influenced human thinking for thousands of years and have long guided the perception we have of others and ourselves: the keeper of knowledge (the digital library), the communicator (electronic mail), the trader (electronic market place) and the adventurer (digital world).

[12] In a similar sense, "*Utopias are a way of forecasting the future*" (Flichy & ebrary Inc., 2007, p. 209)

Thirdly, metaphors are reality-constructors, superimposing their own image and representation upon the object represented. In this way, metaphors and other imaginary conceptualizations applied in the dynamic field of electronic communications often present the "baudrillardian" tendency of surpassing or even abolishing the real, replacing it with their own construction of reality. This "demiurgic" nature is, moreover, an element connecting metaphors and the Internet, as both of them share this tendency of creating and constructing their own realities. In the case of the latter, there is, in fact, a recognized strong link between computers and the creation of universes. Kevin Kelly, editor in chief of Wired, perceiving the link between computer and the creation of the universe, stated once that: "*The reason why the hippies and people like myself got interested in [computers] is that they are model worlds, small universes. They are ways to recreate civilization.*"[13] Furthermore, also Alan Kay, researcher at Xerox Park and considered to be one of the founding fathers of the microcomputer, noted: "*Computer science inverts the normal. In normal science you're given the world and your job is to find out rules. In computer science, you give the computer the rules and it creates the world. And so we have the reductionism dream. We can build the whole universe from just one principle*."[14] This association between computers and the creation of universes explains, moreover, why the Internet has deserved so many metaphors attached to it and why it is so suited for those symbolic representations. This is due, as a matter of fact, to the plastic nature of the Internet, which renders the medium particularly suitable for the apposition of metaphors. In this sense, Vinton Cerf explains that "*the Internet can become anything we can imagine and program it to be*" as "[i]*t is a most malleable and evolving infrastructure*."[15]

Accordingly, and considering the Internet as a technology enabling and representing worlds, the use of metaphors to label the latter constitutes a perfect combination. In this sense, one completes the other: the metaphor expresses the reality which the internet later fulfils (although not always, as we will see with the example of "giant brains" and computers). This common demiurgic element can be found in the words of David Holmes (1997), who, referring to technologies that foster "*the ability of human beings to replace, simulate and indeed reconstitute the world by way of technoscience…*" (p. 2), explains that "*technosocial realities have a world-constituting logic to them*", which "*is one of the simulation and substitution of older forms of nature and culture*" (p. 1).

All of these three fundamental characteristics demonstrate that metaphors, in reality, do not live in an imaginary harmless vacuum, wandering away from any glances of real life. In fact, the common acceptance and adoption of such metaphors can yield practical implications, causing real-world changes and determining the further development of the Internet itself (taken in its physical dimension).

[13] Quoted in Paul Keegan, "The Digerati", New York Times Magazine, 21 May 1995.
[14] Alan Kay and Danny Hills, "Kay-Hillis", Wired, January 1994, p. 148 (qtd. in Flichy & ebrary Inc., 2007, p. 122).
[15] Vinton Cerf, Foreword to "Internet Dreams" (Stefik, 1996).

The Importance of the Metaphorical Speech

The use of metaphors or any other illustrative terms or symbolic expressions aimed at capturing the essence and meaning of a new technology is not new or exclusive of the Internet. As Flichy (2007) points out, the cyber-imaginaire reveals "*something similar to the great utopias of the 17th and 18th centuries in which functioning of a different world was described*" (p. 17).

One example of a metaphor used to represent another technological device was the metaphor of "giant brains", which was created in the 1950s to describe computers. As Stefik (1996) explains, the "giant" came from the enormous size of the computers of that time, as they occupied entire rooms: "*[t]hroughout the 1960s and 1970s, most people thought of a computer as a big machine with flashing lights and spinning tapes that filled a secure, air-conditioned room and was attended by experts*" (p. xvi). As for the brain allusion, it was supposed to reflect the intelligent way in which computers worked. Such metaphor was, nevertheless, misleading, as "*it failed to predict the actual future of computers or to guide their future development*" (Stefik, 1996, p. xvi). In fact, computers turned out to become a lot smaller and very little of what they do correspond to what we normally call thought (Stefik, 1996, p. xvi). This particular example shows that metaphors are fallible and that, sometimes, they do not succeed in conveying the right representation and understanding of the object they are referring too. Metaphors, as a reflection of the human understanding, can either be right or wrong; can either be influential and empowering or not; can either forecast the future evolution of a particular object, guiding its future developments or failing to do so. The metaphorical dimensions of the Internet deal with the symbols, the images, the utopias, the imaginary and the figurative speeches surrounding the creation and the development of this communicational machinery. This symbolical view contrasts with the "mechanical" and the objective analytical perspective of the Internet (physical dimension), offering an imaginative, allegorical and symbolic construct of this particular medium of communication. In this way, while the "physician" dissects the physical machinery into its various architectural components, analysing how they work and relate to each other, the "metaphorical" observes how the new technology - taken in its entirety – changes people, influences mentalities and transforms society, striving to understand the meaning and importance of this medium of communication, as well as exploring its future implications.

The Metaphorical Internet and its various terms

In the book "Art and Physics: Parallel Visions in Space, Time, & Light", Leonard Shlain (1991), pointing to an intriguing relationship between artistic and scientific evolution, claims that "*art has always been a powerful if unacknowledged driving force behind science and technology, rather than a kind of sideline*

commentary".[16] In this context, the author argues that "*the visionary breakthroughs of specific artists prepared everybody, including scientists, for the changes in thinking that scientists would introduce*".[17] The artists, thus, were pioneers in conjuring up images and metaphors that later on became part of the conceptual framework of the scientific knowledge about physical reality.[18] Picking up this idea, a very similar process is taking place between the Internet (perceived in its physical configuration) and its metaphorical (and, thus, artistic) constructions. As such, the art-metaphors are also inspiring and guiding the development of the "scientific" Internet. In this case, the artists pertain to a heterogeneous group of futurologists, visionaries and science-fiction writers. Through their artistic (mainly literary) work, these intellectuals have been paving (and, in a certain sense, anticipating) the way for future developments in the modern world of communications technologies, elaborating some of the most important metaphors expressing and representing the Internet.

The Internet has, thus, been represented and conveyed through the use of different metaphors, some taken from real-world existing examples (information highways), others through constructed notions merging in one single term different ideas and conceptions, such as information, cybernetics, sphere, universe and space (giving place at terms such as *infosphere*, *noosphere*, *cyberspace* and *metaverse*). Moreover, all these different metaphors have different backgrounds, describing the phenomenon of the Internet based upon different suppositions and postulations, ranging from religious doctrines and metaphysical assumptions, to literary purposes or political agendas. In the following, the paper proceeds to the analysis of the most relevant metaphors that have been craved to describe and represent the world of the Internet.

Noosphere

The first and most paradigmatical example of art preceding science is the concept of *noosphere* (already briefly mentioned), coined by the French philosopher and palaeontologist Teilhard de Chardin.[19] Despite being invented half a century before the very existence of the Internet, the term, nevertheless, is usually considered an anticipated metaphor of the latter.

The *noosphere* is part of the French philosopher's theory of metaphysic evolution, according to which man is evolving, mentally and socially, towards a final spiritual unity.[20] John Perry Barlow, in an interview, made

[16] http://www.rheingold.com/texts/reviews/artphysics.html
[17] *ibid*
[18] *ibid*
[19] The authorship of the term noosphere is, nevertheless, questionable, as some observers point to other possible authors, namely Vladimir I. Vernadsky and Edouard Le Roy.
[20] Teilhard de Chardin, Pierre. (2008). In Encyclopædia Britannica. Theologically, Teilhard saw the process of organic evolution as a sequence of progressive syntheses whose ultimate convergence point is that of God.

the following comments to Teilhard and the notion of noosphere "[He] *used to talk about something called the noosphere which was the combined field of all human consciousness, and how that became stronger and stronger as civilization progressed and how what God wanted was to have someone to talk to on its own level, and that was what humanity was in the process of creating. That comes as close as I can to describing what I think is going on*."[21]

Deriving from the Greek vouç ("nous"), which means "mind", the noosphere can be seen as the sphere of human thought. According to Teilhard, who attempted to "combine Christian thought with modern science and traditional philosophy",[22] the noosphere develops from the interaction of human minds, culminating in a higher stage of human collective consciousness. Such global consciousness of mankind ultimately becomes "the thinking layer of the Earth", i.e., the *noosphere*. As modern communications technology (namely the Internet) and the *noosphere* both seem to postulate that the universe is constantly developing towards higher levels of material complexity and consciousness,[23] the link between the two was easily drawn. In other words, as the conception of the *noosphere* demonstrates surprising similarities with the so-called notion of collective intelligence, the application of the latter to symbolize and represent the Internet was practically inevitable. Moreover, both concepts point towards an increasing and evolutionary level of socialization, leading towards and even greater human integration and unification.

Information Highways

Contrarily to the noosphere, metaphor which was grounded in a complex philosophical reasoning, grasping metaphysical conceptions and carrying theological implications, this next metaphor – the information highways - is a much more straightforward and "earthy" metaphor, depicting "*an intricate tangle of communication lines connecting computer sites on a map of the United States*" (Stefik, 1996, p. xvii), illustrating the idea of rapid circulation of information.

The idea of an "electronic highway" goes back to the 1970s and draws a comparison between the large federal subsidies that were invested during the 1960s in "*a new interstate highway system to facilitate and modernize the flow of automotive traffic in the United States*",[24] and the need to "*make a similar commitment for an electronic highway system, to facilitate the exchange of information and ideas*" (Flichy & ebrary Inc., 2007, p. 18). Such metaphor associated the idea of a new infrastructure with the electronic world, endorsing a communication utopia around the themes of networked society and cable nation (Flichy

[21] Quoted in (Dery, 1996, pp. 47-48)
[22] Teilhard de Chardin, Pierre. (2008). In Encyclopædia Britannica.
[23] The maximum level of such complexity and consciousness is termed "Omega Point."
[24] Ralph Lee Smith, *The Nation*, 18 May 1970, 602 (qtd. in Flichy & ebrary Inc., 2007, p. 18). Smith (1972) afterwards developed his theses in a book: Smith, R. L. (1972). *The wired nation; cable TV: the electronic communications highway* ([1st ed.). New York,: Harper & Row.

& ebrary Inc., 2007, p. 18). This utopia, moreover, promised to reunite people, while delivering interactive television, movies-on-demand, telechat and teledemocracy (home voting) (Flichy & ebrary Inc., 2007, p. 18). Nevertheless, and as Flichy notes, this utopia failed to be implemented in a technical system, evolving later on from technical utopia to political ideology:

> "*Unable to develop into a project, the utopia took a turn and mutated into a mask ideology. As the imaginary project was gradually emptied of its substance, it found another content: the justification for a telecommunications liberalization policy*" (Flichy & ebrary Inc., 2007, p. 17).

The "information superhighway" was widely diffused during the US presidential campaign of 1992, owing great part of its popularity to the Vice President Al Gore who explained that "*[o]ne helpful way is to think of the national Information Infrastructure as a network of highways – much like the Interstates begun in the fifties.*"[25] The idea was to use "*the highway metaphor to predict the future of the national information infrastructure in an attempt to influence people*" (Stefik, 1996, p. xix), obtaining the necessary government funds to build the network and to foster American prosperity, following the successful example of the interstate highway system.

Nevertheless, this particular metaphor failed at the cognitive and at the prospective levels. Concerning the latter, and as already briefly mentioned, this technical and promising vision was never realized in concrete terms, failing to shape the future it announced and ending as "*an ideology used to legitimize a liberal policy that had difficulty being fully accepted*" (Flichy & ebrary Inc., 2007, p. 30). Regarding the cognitive dimension, the information highways metaphors were useful for picturing information as traffic (describing how bits and bytes travel on wires and offering a mental image of information flowing around the country) (Stefik, 1996, p. xix), as well as "*for thinking about connectivity, speed, communications charges, and infrastructure*" (Stefik, 1996, p. xix). Nevertheless, the information highways carried also with it "*misleading terms associated with roads*" (Stefik, 1996, p. xix). The list of discrepancies between regular highways and "informational" ones can be summarized as following:

> "*Highways, for example, are planned and designed, whereas information highways are self-organizing and have no central planner. Highways are constructed with taxpayer dollars; information highways will ultimately be financed mainly by private investment. Highways have fixed configurations and connect fixed physical locations; information highways have ever-changing configurations and link changing information sources*" (Stefik, 1996, p. xix).

In addition, the information highways metaphor, mainly because of the political context in which it was divulgated and popularized, was traditionally connected with the government, underlying a very questionable assumption about its intervening power and centralized planning role upon the internet. In a

[25] Vice President Albert Gore, National Press Club, December 21, 1993; quoted in Stefik (1996, p. xv).

similar sense, the image of information highways could also be interpreted as inspiring an idea of appropriation and totalization:

> "*Impelling this image of the Internet as a "superhighway" is … a certain will to power which merely continues historical ideologies of totalization. By being constructed metaphorically as a conquest of space, through an equally illusory notion that is possible to travel in 'cyberspace', power is effectively 'transferred from the real to the hyperreal', enabling a fulfilment of a modernist drive towards mastery of the world*" (Holmes, 1997, p. 15).

Although extremely popular in the press namely during the nineties,[26] this metaphor had "*very little ability to explain either where the Internet arose or where it could go*",[27] failing to appropriately understand and represent the Internet, ending up as an empty metaphor exploited for political purposes.

Cyberspace

Cyberspace is a polysemic, seductive, empowering and misleading term. As the most popular and widely diffused metaphor for Internet, the concept of cyberspace was born in cyberpunk science fiction novels, developing later into a common term used to represent the internet and to convey the wide array of different activities that the global network of computers renders possible. This concept has received an enormous attention from lawyers, anthropologists, sociologists, philosophers and economists (among many others), generating a burgeoning and vast literature.

Technically speaking, cyberspace may be defined as a generic term encompassing a whole group of technologies, all of which with the ability to simulate environments within which humans can interact (Featherstone & Burrows, 1995, p. 5). Metaphorically speaking, the term cyberspace (which is, moreover, metaphorical in its nature) expresses a kind of ideal and rather intangible space projected by the network of computers, a sort of autonomous realm existing within switches and electrical impulses. According to Bruce Sterling,

> *Cyberspace is the "place" where a telephone conversation appears to occur. Not inside your actual phone, the plastic device on your desk. Not inside the other person's phone, in some other city. The place between the phones. The indefinite place out there, where the two of you, human beings, actually meet and communicate* (Sterling, 1992).

[26] In fact, the Information highway metaphor even served as a theme for a famous April Fool's gag in 1994, as Wired recently remembered: *"A proposed law will ban online sex chat and inebriated Web surfing. 'Congress apparently thinks being drunk on a highway is bad no matter what kind of highway it is,' editorializes PC Computing. The bill's supposed sponsor, Senator Ted Kennedy, is not in on the joke. After an onslaught of complaints from drunken perverts, he issues a formal denial."* in http://www.wired.com/culture/lifestyle/magazine/16-04/st_best

[27] Vinton G. Cerf, foreword to "Internet Dreams" (Stefik, 1996, p. x).

"*Hence, cyberspace has been conceptualized as … a place constructed out of information"*, configuring "*not merely a medium easily controlled, but another place altogether*" (Karatzogianni, 2006, p. 44). The term "cyberspace" (which etymologically conveyed already the idea of a place, a space) is, thus, a geographical metaphor used to represent the "non-physical" place produced by these computer systems and networks, i.e., the virtual location projected by this electronic machinery, where information could be stored, retrieved, transmitted and processed, and where online communication could take place.[28] As we shall see, such a geographical connotation is misleading.

1. Origins of the Metaphor

The term cyberspace (from cybernetics[29] and space) was coined by William Gibson in his influential novel *Neuromancer* (1984).[30] According to the latter, cyberspace entailed a world-wide "*consensual hallucination*" (Gibson, 1984), in which people, equipped with neural jacks, would be able to plug their minds directly into this digital matrix and travel through cyberspace as separate and disembodied entities. As described in this book and several later novels, cyberspace was depicted as an artificial environment created and maintained by computers.

Cyberspace would consist, on the one hand, in an electronic "consensual hallucination" experienced by a large number of users (into which they would literally plug their brains) and, on the other hand, in a system for processing graphic representation of data abstracted from the banks of every computer in the human system. As Flichy notes, although those meanings of cyberspace may initially appear antagonistic, they are in fact profoundly complementary. In this sense, "*[c]yberspace is a complex collective fantasy that is also really operational*" (Flichy & ebrary Inc., 2007, p. 126).

2. Gibson and the importance of cyberpunk literature

The work of Gibson is a paradigmatical example of the important role played by science-fiction novelists, namely the ones pertaining to the denominated cyberpunk literature, in shaping the understanding of the Internet. Such literary movement, "*a science-fiction subgenre characterized by countercultural antiheroes trapped in a dehumanized, high-tech future*",[31] provided revolutionary concepts and visions to the

[28] In this sense, cyberspace "*gives a name to the otherwise abstract notion of the place where artificial computers meet real human minds, where information processing meets telecommunications*" (Rojas, 2001)

[29] "The word "*cyber*", referring to the science of cybernetics, derives from the Greek verb "Kubernao", which means "to steer" and which is the root of our present word "to govern". It connotes both the idea of *navigation* through a space of electronic data, and of *control* which is achieved by manipulating those data", F. HEYLIGHEN, Principia Cybernetica Web, "Cyberspace", http://pespmc1.vub.ac.be/CYBSPACE.html (1994)

[30] Besides Neuromancer (Gibson, 1984), the term "cyberspace" is present in several of other Gibson's writings, such as in Count Zero (Gibson, 1986b) In Burning Chrome (Gibson, 1986a), Gibson uses the term "consensus-hallucination."

[31] Cyberpunk. (2008). In *Encyclopædia Britannica.*

idealization of the net. In the words of Jordan, commenting on the effects of cyberpunk culture on cyberspace:

> "*While it is clear that cyberpunk was a movement, its ideas have had a much broader effect than on just science fiction. Two ideas in particular were prefigured in cyberpunk science fiction that have had a lasting effect on cyberspace: the organization of information as virtual spaces and the nature of virtual bodies…The first is the most significant, because it attempts to directly describe, picture, dissect and understand cyberspace"* (qtd. in Karatzogianni, 2006, p. 44).

The value of this literature for the correct perception and discernment of what the Internet was and meant is confirmed by Gibson, who saw his novels as an instrument of social critique: "*What's most important to me is that it's about the present. It's not really about an imagined future. It's a way of trying to come to terms with the awe and terror inspired in me by the world in which we live*" (Flichy & ebrary Inc., 2007, p. 116). As for Sterling, another famous cyberpunk writer, the idea was to produce a "*sense of history*," in order to reconstruct an ideological narrative based on observed phenomena (Flichy & ebrary Inc., 2007, p. 116).

Gibson's work, in specific, has been regarded as highly influential in many different scientific fields and areas of knowledge. In this sense, some observers, such as anthropologist David Tomas, consider that Gibson influenced research on computer technology, as "*he does provide some ideas for imagining a particular device or embarking on a project*" (Flichy & ebrary Inc., 2007, p. 127). Moreover, Gibson's powerful vision provided "*an imaginary public space and a community of debate that opened the way to new modes of interaction*" (Flichy & ebrary Inc., 2007, p. 127).[32]

3. Behind the Metaphor (or the false, yet believable, geography of Cyberspace)

Although the human mind (and imagination) has conceived the contextual environment in which a complex web of interconnected computers stores, processes and carries information as a place and location in itself, cyberspace – although a clearly geographical metaphor - is not really a place.

Rejecting the idea of a place but still looking at the Internet in its metaphorical dimension through the concept of cyberspace, the latter is, at the most, a mental place,[33] the "new home of the Mind",[34] a

[32] Another example asserting the importance of the "cyberpunk" metaphors in the conceptualization and implementation of new technological settings is the case of the commonly denominated "virtual worlds." The technological construction of these new digital environments was also inspired by previous images and metaphors coming from the cyberpunk literature, such as the "Other Plane" of Vernor Vinge (True Names, 1984), the "Mirror Worlds" of David Gelernter (Mirror Worlds, 1991) or the "Metaverse" of Neil Stephenson (Snow Crash, 1993). The latter term was, in fact, coined as a successor to the Internet, constituting the author's vision of how a virtual reality-based Internet might evolve in the near future. Metaverse was, thus, a virtual world – a three dimensional simulation of reality in cyberspace – where people lived, worked, and socialized.

[33] In a similar perspective, "[*C]yberspace can be understood as a mental space of* attention *where people are when they are engaged in electronic communication (thus even a person reading email or talking on the telephone is 'in cyberspace')*", S. MIZRACH, "Lost in Cyberspace: A Cultural Geography of Cyberspace", http://www.fiu.edu/~mizrachs/lost-in-cyberspace.html

[34] J.P. Barlow, "A Declaration of the Independence of Cyberspace", February 1996, http://homes.eff.org/~barlow/Declaration-Final.html

"consensual hallucination" or a metaphysical space of pure mind, triggered by the use of information technologies (namely the Internet) and shared by millions of people all over the world. In the words of John Perry Barlow, who initially called it *Datasphere*, cyberspace "*consists of electron states, microwaves, magnetic fields, light pulses and thought itself, arrayed like a standing wave in the web of our electronic processing and communication systems*."[35] Such definitions and observations suggest that cyberspace equates to the combination between the physical machinery of the internet and the psychological human mind operating it. Accordingly, it is the intertwining of electrons and feelings, bites and thoughts, and other technical and mental elements that compose cyberspace, rendering difficult its perception and understanding. In this sense, cyberspace is "*the no-man's land where computer and computer networks, artificial intelligence, and virtual reality overlap with people's minds and feelings, where the technoscientific world of silicon chips and fiber optics meets the psychosocial world of living, breathing human beings*" (Rojas, 2001). As a depository of information and engine of interaction promoted by the functioning of an intricate network of computers and electronic processing systems, cyberspace represents an unprecedented human stage of communicational accessibility, interactional capability and knowledge availability. Such a vision of cyberspace is similar to the one of *noosphere* (Teilhard de Chardin, 1964), who, as already explained, postulated that human evolution would ultimately produce the so-called "noosphere" of knowledge that would envelop the earth just as palpably as does the current atmosphere and ionosphere (Ralston, Reilly, & Dahlin, 1993). Although the philosopher envisioned mental, quasi-spiritual interconnections rather than electronic, the idea of cyberspace as a collective and consensual state of communication and interaction was already present.

Nevertheless, and due to the fact that such "transcendental" conceptions of cyberspace reinforce its level of abstraction, keeping such notion on a stratospherical level of understanding for any common mortal; a more concrete, easy, workable, yet misleading metaphor was used to characterize cyberspace in detriment of the transcendentalist perspective. Cyberspace was thus seen, not as a conscious and collective mental layer clouding over us, but as a Place in itself. We shall first analyse the "metaphysical" connotation attached to cyberspace, and secondly – regarding the evolution of the concept, we shall address the geographical assumption accompanying the debates and the evolution of the metaphor cyberspace.

[35] J. P. Barlow, "Coming into the new country: cyberspace, the new datasphere," in *Communications of the ACM*, Vol. 34 No. 3, March 1991, pp. 19-22.

4. Cyberspace and Techno-transcendentalism: tension between postmodernism and critical realism

Paraphrasing Vasseleu, "*the metaphysics of computer simulation was already articulated in the Copernican revolution as a theoretical paradigm of necessity of universal illusions*" (Holmes, 1997, p. 10). Nevertheless, the association between metaphysics and communication processes became more evident and meaningful with the arrival of computers and the building of the internet network. As such, those technological breakthroughs of modern communication technologies made the world smaller and brought people together, allowing them to share and exchange, in an easier and swifter way, ideas and thoughts. This global unifying effect, resulting from the "assemble" of these technologies, constituted the main reason behind the emergence of the so-called techno-transcendentalism, which had as its mains contributors Marshall McLuhan and Pierre Teilhard de Chardin, who established, each one in a different way, the teleological foundations assisting and accompanying the development of modern communications technologies.

Marshall McLuhan envisaged that the concept of "global village", borne of communications technology, would evolve, over time, into a vision of the "[p]sychic communal integration" of all humankind, "made possible at last by electronic media" (Dery, 1996, pp. 45-46). According to McLuhan, the physic convergence facilitated by electronic media "*could create the universality of consciousness foreseen by Dante when he predicted that men would continue as no more than broken fragments until they were unified into an inclusive consciousness."*[36] Teilhard de Chardin, as it has already been mentioned before, announced the coming of an "*ultra-humanity*" destined to converge in an "Omega Point" – a "*cosmic Christ*" who is "*the consummation of the evolutionary process*" (Dery, 1996, pp. 45-46).

More recently, and drawing from the cyberpunk genre, which is "*engaged in the postmodern activity of deconstructing human subjectivity as its narratives 'radically decenter the human body, the sacred icon of essential self*',[37] cyberspace has been stamped with a renewed metaphysical imprint, inspiring ideas of transcendence beyond the physical world and the human body.

In this context, postmodern philosophical perspectives postulate "*that through online communication (in the absence of the body and visual and verbal cues) human beings are in the process of remaking themselves by redescribing themselves and their world in discourses enabled by new technologies*" (López & Potter, 2001, p. 168). Moreover, and following the postmodernist philosophers doctrine, cyberspace possesses an emancipative nature, operating as a vehicle for transcendence and offering "*the opportunity of freeing ourselves from the constraints of the natural and our physical bodies*"(López & Potter, 2001, p.

[36] As explained by the McLuhan, the physic convergence towards the universality of consciousness is, in a Christian sense, "*a new interpretation of the mystical body of Christ; and Christ, after all, is the ultimate extension of man"* ((Dery, 1996, pp. 45-46)

[37] Hollinger, V. (1990) 'Cybernetic Deconstructions: cyberpunk and postmodernism', Mosaic, Spring, 23:2, 29-44 (p.33).

164). In the words of Fisher "*we yearn for the hypercorporeality of cyberspace where we can leave behind the physical and mental limitations of our bodies…Cyberspace is the postmodern paradise, where we forget the ills of our past lives in total presence of absolute recall made possible by the relentless virtualisation of reality.*"[38] In a nutshell, postmodernism claims that

> "*cyberspace allows us to escape from physical necessity, and gives us the freedom to redescribe ourselves and our world; and in the process create our (simulated) selves and replace the real world with a simulation*" (López & Potter, 2001, p. 164).

Nonetheless, these notions and promises of transcendence, disembodiment and freedom have been counter-argued by the realist perspective, which emphasizes the need to take into account the "*limits imposed by the world and by human biology upon what it is possible for human beings to be and do*" (Soper, 1995, pp. 34, qtd. in López & Potter p.165) and reminds us that human beings are determined by biology to the extent that they are "*embodied mortal entities with specific genetic endowments and possessed of a particular sexual anatomy and physiology*" (Soper, 1995, pp. 125-126, qtd. in López & Potter p.166). While postmodernists attach great importance to the discourses enabled by technology (seeing in them an occasion for disembodiment and freedom), "*a realist perspective takes account of the extra-discursive reality of the physical world and the physical body*" (López & Potter, 2001, p. 168). In this light, the realists argue that the postmodernist discourses are not performative, being only efficacious and meaningful within the online sphere. As such, the postmodernist assertions seem to confine themselves to cyberspace, loosing their meaning in the "real" physical environment. Following this realist reasoning, Collier (1994) calls the freedom advocated by postmodernists an "out of gear concept", as such freedom bears no meaning "if online discourses are enable to be causally efficacious in the real world" (López & Potter, 2001, p. 164).

Bearing in mind that forthcoming technological scenarios will merge the physical with the digital, replicating our digital identities while simultaneously restoring the importance of our physical body, i.e., conciliating within the same environment virtual disembodiment and physical embodiment, the future philosophical visions and interpretations of this post-cyberspace will have to go beyond the limited parameters of both postmodernists and realists. Post-cyberspace will find itself between transcendental elements and material features, requiring a philosophical vision that can surpass the classical dichotomy between virtual and physical world.

[38] Fisher, Jeffrey. "The Postmodern Paradiso: Dante, Cyberpunk, and the Technosophy of Cyberspace" (in Porter, 1997).

5. Evolution of Cyberspace

The history of the evolution of cyberspace (or of how such metaphor was understood and what image of the Internet projected) is deeply interrelated with the history of the evolution of the "physical" Internet itself and with the idea of geography and place. As the actors driving the development of the Internet changed over time (from academic researchers to governments and large private companies), shaping the global network to the pursuit of their different interests, not only did the Internet change profoundly, but also the meaning of the metaphor representing it: cyberspace.

The Internet began as an open information network financed through military budgets and operated by a talented generation of university researchers. The culture of freedom (Castells, 2001) and the constant exchange of ideas and knowledge among the pioneer Internet members allowed for the rapid and impressive development of this global network. During this period of openness and freedom, cyberspace was pictured as a new and autonomous territory, with no relations whatsoever with the real world. Such reasoning gave birth to powerful libertarian statements vis-à-vis cyberspace. Early Internet theorists proclaimed that cyberspace was immune to any attempt of regulation from external entities, as its destiny was to be completely self-governed.[39] The most emblematic symbol of this era of freedom, autonomy and self regulation was the famous Declaration of Independence of Cyberspace, which proclaimed, rather triumphally, the sovereignty of cyberspace. Those were the early days of cyberspace, which, depicted as a separate and different place from real-world, conveyed the image of an independent and autonomous Internet. States, thus, looked at the Internet like a strange creature, failing to understand and control.

With the passing of time, the development of technologies and the globalization of the net, the image of an independent and self regulated Internet conveyed by the geographical metaphor of cyberspace suffered fundamental transformations. Captured by powerful economical interests and transformed into an infrastructure of and for the masses, the Internet lost its innocence, becoming privatized, commercialized and highly politicized. Confronted with those major alterations, the cyberspace metaphor also changed, slowly ceasing to depict the Internet as a unique and independent realm, but just as another standard place. This is what Margolis and Resnick (2000) have called the normalization of cyberspace, a process through which the latter comes to resemble more and more the real world. Moreover, the previous borderless character of cyberspace can now be easily resolved with the implementation of new technologies, such as geo-location software[40] and powerful filtering tools.[41] In addition, States are reasserting their control

[39] John Barlow, *A Declaration of Independence of Cyberspace* (Feb 8, 1996) at http://www.eff.org/~barlow/Declaration-Final.html, "*demanding that the industrialized nations of the world leave cyberspace alone, since it and its denizens were so unlike any physical world counterparts*". Moreover, "[t]*his governance will arise according to the conditions of our world, not yours. Our world is different.*"

[40] Software which allows for the geographical location of Internet users.

[41] Through these filters, access to the internet can be limited based on a given user's country of origin.

and influence over the Internet, inserting geographical boundaries in cyberspace[42] and reducing the Internet's architecture of anonymity.

In short, the original Internet - borderless, anonymous and forbidden territory for State regulation – is now an area with geographical borders, less anonymous, more intrusive (capable of identifying and tracing every user in cyberspace) and subject to State regulation. The Internet libertarian views, claiming the uniqueness and independence of its metaphorical place - the cyberspace - are clearly out-dated. In effect, online and offline "worlds" are more and more on the same line.

In fact, the coming together of online and offline worlds, virtual and non-virtual spaces, and physical and digital elements will be the next big evolutionary step for cyberspace. In this way, cyberspace will become the complete opposite of how it was pictured at the beginning – moving from the status of an autonomous and independent domain towards a component of the physical world. With the development of artificial intelligence, the growth of intuitively intelligent interfaces embedded in any kind of object and the deployment of software agents, man will be constantly surrounded by interactive, yet invisible, machines - leading to what has been called: Ubiquitous Computing and Ambient Intelligence (AmI).[43]

In the future, cyberspace will jump from computers to everyday objects (furniture, clothes, objects, etc). It will no longer manifest itself solely through a graphical page or scenario depicted on a computer screen; it will just simply exist among us in everyday life. "*According to this vision, people will not just use technology: they will live with it.*"[44]

As an initial metaphor for an autonomous space, conveying ideas of sovereignty and independence, cyberspace – due to its normalization process – ended up emptying itself of any particular meaning, being now interchangeably used as a synonym for the Internet. With the "death" of the metaphorical cyberspace and with the continuous evolution and expansion of the Internet, along with its integration with other technologies, new visions and metaphors are being created to represent this expanded and renewed vision of the ICT's – Ubiquitous Intelligence and Ambient Intelligence.

Transition: The World after Cyberspace…

Cyberspace, as we know it, will end. For decades conceived as a sort of distinct realm of human action or an autonomous place through which we consciously enter (by, for example, switching on the computer and

[42] Jovan Kurbalija states that "The Internet increasingly becomes anchored in geography", Internet Governance and International Law, in Reforming Internet Governance: Perspectives from the Working Group on Internet Governance (WGIG), (ed. William Drake), United Nations, 2005 - Drake, W. J. (2005). Reforming Internet Governance: Perspectives from the Working Group on Internet Governance. New York: UN ICT Task Force (available at http://www.wgig.org/docs/book/WGIG_book.pdf).

[43] While the emphasis of cyberspace is on simulation of environments, recreation of places and on the virtual element as an isolated reality, Ambient Intelligence (AmI) emphasis the superimposing and embedment of electronic systems into the physical environment, as well as the meddling of virtual and non-virtual elements.

[44] Gaggioli, Andrea. "Optimal Experience in Ambient Intelligence" (in Riva, 2005, p. 35).

looking at the monitor), cyberspace will be, in the future, omnipresent, omniscient and invisible, hidden in the background of our environment. This process is gradually taking place, as cyberspace is slowly abandoning the traditional desktop computing paradigm and integrating furniture, clothes and toothbrushes...

Introducing the new setting: Ambient Intelligence and Ubiquitous Computing

Moving now to a near future, and confident that time will keep flowing and technology inexorably developing, the setting previously described (the Internet) and its corresponding metaphorical vision (cyberspace) will be radically transformed, giving place to a larger and more powerful physical infrastructure, as well as to a whole new metaphor and vision: the Ubiquitous Computing (UC) and the Ambient Intelligence (AmI) scenarios.[45] These technologies will provide the setting of the future, where man and machines will be embedded together, in an indissoluble environment.

We are, thus, moving towards a setting completely different from the one described previously. The previous technological scenario[46] (taken in its physical dimension) was made of conventional computing and traditional user interfaces, such as keyboards, desktops and visual displays. The new technological scenario will, instead, be made of furniture, clothes, utensils, pens, books and any kind of physical object you can think of,[47] all embedded with some kind of intelligence and forming a communicative, sensitive, responsive, interactive and functional network.[48] The "internet" as we know it – in the shape of a network of computers – will gradually envelope the physical environment, distributing the technology focus and its computing power from computers to an infinite multiplicity of everyday objects.[49] The passage from the present internet structure (which currently covers only a limited number of output devices) to an ubiquitous one will be done through an increasing miniaturization of computer technology, which "*will, in the foreseeable future, result in processors and tiny sensors being integrated into more and more everyday objects, leading to the disappearance of traditional PC input and output media such as keyboards, mice, and screens.*"[50] According to the same vision, "*we will communicate directly with our clothes, watches, pens, and furniture – and these objects will communicate with each other and with other people's objects.*"

[45] Although some authors distinguish between these concepts, for the sake of simplicity they will be seen as synonyms, being used interchangeably.
[46] Although by far still the dominant one nowadays
[47] "*This involves seamless integration of nano- and opto electronics, natural user interfaces and integration of electronics in new computing substrates like fabrics and plastic*", Alcañiz, M.; Rey, M., "New Technologies for Ambient Technology" (in Riva, 2005, p. 4).
[48] "*It is a world of smart dust…where the clothes you wear, the paint on your walls, the carpets on your floor, and the paper money in your pocket have a computer communications capability*" (Wright, 2008, p. 1).
[49] This trend has been identified and widely divulgated by Unesco as "The Internet of Things."
[50] Bohn, J.; Coroama, V,; Langheinrich, M.; Friedmann, M.; Rohs, M. "Social, Economic, and Ethical Implications of Ambient Intelligence and Ubiquitous Computing", (in Weber, Rabaey, & Aarts, 2005, p. 5).

[51] As such, the current and forthcoming wave of Information and Communication Technologies will spread the internet into the physical environment, replacing the old Cyberspace with the new Ambient Intelligence. This transition is and will be achieved through the further development of a number of dominant trends, namely the following ones:

> -"*The increase of richness and completeness of human-computer interaction, through technology extensions of the senses and of the human body;*
>
> *- The relevant role of mobility, through the development of mobile communications and extended networks;*
>
> *- The pervasive diffusion of intelligence in the space around us, through the development of advanced biosensors.*"[52]

Departing from technological advances in the fields of miniaturization, computing power, embedded intelligence and wireless connectivity, the new and exciting environment of AmI will be characterized, on the one hand, by its invisibility, discretion and unobtrusiveness and, on the other hand, by its sensitivity, interactivity and responsiveness.

Regarding the latter, the fundamental paradigm of ambient intelligence is that computers disappear from the user's consciousness and recede in the background. In this way, computers and other processing and "intelligent" devices (such as sensors, tags and actuators) will be seamlessly integrated into ambient, working discreetly and unobtrusively in the backstage. Being as small as to be practically invisible, these intelligent devices will be often imperceptible to human's awareness and perception. Electronic systems, in fact, will be "*so small, cheap and power efficient that they can be attached to any possible object or dispersed in the ambient.*"[53] The "assimilation" of these electronic devices by everyday objects will be the "secret" behind the invisibility effect. Hence, the reason why this technology is regarded as invisible is because it is "*integrated into the general ecology of the home or work place as, for example, a desk, chair or book.*"[54]

In terms of sensitivity and responsiveness, the AmI environment will populate the earth with an almost infinite number of smart objects:[55] artefacts, things or substances capable of exploring and sensing the

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[51] *Ibid*.
[52] Riva, G. "The Psychology of Ambient Intelligence: Activity, Situation and Presence (in Riva, 2005, p. 18).
[53] Lindwer, M.; Marculescu, D.; Basten, T.; Zimmermann R.; Marculescu R.; Jung, S.; Cantatore, E. "Ambient Intelligence Visions and Achievements: Linking Abstract Ideas to Real-World Concepts", Proceedings of the conference on Design, Automation and Test in Europe – Vol.1, IEEE Computer Society, 2003, p.10012. The production of electronic systems through miniaturization corresponds to the concept of "smart dust." For further information on "smart dust", see B.Warneke, M. Last, L. B., and K. Pister. Smart dust: communicating with a cubic-millimeter computer. *IEEE Computer,Vol. 34, No. 1*, pages 44–51, January 2001.
[54] Buxton, W. (1995). Ubiquitous Media and the Active Office. Published in Japanese (only) as, Buxton, W. Ubiquitous Video, *Nikkei Electronics*, 3.27 (no. 632) (1995),187-195 (qtd. in Riva, 2005, p. 4).
[55] The foreseeable technological developments will therefore add an additional new quality to everyday objects – "*these might be able not only to communicate with people and other "smart" objects, but also to discover where they are, which other objects are in their vicinity, and what has happened to them in the past, for example.*" Bohn, J.; Coroama, V,; Langheinrich, M.; Friedmann, M.; Rohs, M. "Social, Economic, and Ethical Implications of Ambient Intelligence and Ubiquitous Computing" (in Weber et al., 2005, p. 14).

environment; locating and recognising objects and people, *as well as people's* intention;[56] interacting and responding to humans, as well as reacting and communicating with other smart objects. This environment, as such, *"should be aware of the specific characteristics of human presence and personalities; adapt to the needs of users; be capable of responding intelligently to spoken or gestured indications of desire; and even result in systems that are capable of engaging in intelligent dialogue."*[57] An intelligent[58] and intuitive interface pertaining to an AmI environment will, for example, adapt to users "*through sound, scent, shape, and movement*," [59] making use of the large ambient space that encompasses the user and which is not utilized by conventional user interfaces like keyboards and screens.

Moreover, and taking into account that interfaces will be drastically simplified and more intuitive to use, AmI will also be characterized by its "user-friendliness". In this sense, "[*i]nteraction should be relaxing and enjoyable for the citizen, and not involve a steep learning curve."*[60]

In sum, AmI will be "*invisible, embedded in our natural surroundings, present whenever we need it, enabled by simple and effortless interactions, attuned to all our senses, adaptive to users and context and autonomously acting."*[61]

The emergence of the AmI space and the future role of metaphors

With the forthcoming blending between physical and digital spaces, transforming cyberspace in a component of the physical environment and, consequently, rendering it less abstract and disembodied, will the fantastic realm created by metaphors and their *demiurgical* role slowly disappear? Will the so-called normalization of cyberspace, according to which cyberspace is resembling more and more the physical world, drift away any attempt to describe the technosocial reality[62] in a metaphorical way? Will the *cyber-imaginaire* be relegated to inspirational topics and exotic arguments for science-fiction novels and movies? Will there still be room for metaphorical speeches and utopian constructions in an Ambient Intelligence space?

A similar question was posed by Flichy at the end of her book "The Internet Imaginaire". The author asks if such an *imaginaire* has exhausted its usefulness, being just a past memory of a technical utopia that once

[56] Gaggioli, A. "Optimal Experience in Ambient Intelligence" (in Riva, 2005, p. 35).
[57] IST Advisory Group (ISTAG), "Ambient Intelligence: from Vision to Reality" (in Riva, 2005, p. 45).
[58] "*The term "intelligence" in this regard refers to the fact that the digital environment is able to analyze the context, adapt itself to people and objects that reside in it, learn from their behaviour, and eventually recognize as well as express emotions*". Gaggioli, A. "Optimal Experience in Ambient Intelligence" (in Riva, 2005, p. 35).
[59] Alcañiz, M.; Rey, M., "New Technologies for Ambient Technology" (in Riva, 2005, p. 4).
[60] IST Advisory Group (ISTAG), "Ambient Intelligence: from Vision to Reality" (in Riva, 2005, p. 45)
[61] Lindwer, M.; Marculescu, D.; Basten, T.; Zimmermann R.; Marculescu R.; Jung, S.; Cantatore, E. "Ambient Intelligence Visions and Achievements: Linking Abstract Ideas to Real-World Concepts", Proceedings of the conference on Design, Automation and Test in Europe – Vol.1, IEEE Computer Society, 2003, p.10010.
[62] Term borrowed from David Holmes (1997).

played a part in the design of computer networks but that no longer has a role today (Flichy & ebrary Inc., 2007, p. 207). The answer both to this question and to the ones posed above is the same: no.

As Flichy rightly puts it:

> "…*the age of information is not over. Utopias are not opposed to reality; on the contrary, they are one of the elements on which it is built. They are involved not only in the period in which techniques are developed, but also in their diffusion when users and even an entire society have to construct their relationship with the new too*" (Flichy & ebrary Inc., 2007, p. 208).

Taking into account that the AmI vision foresees the conceptualization of a total new environment, inhabited by millions of intelligent software agents and intuitive interfaces, providing a wide array of new services and functions, the role of metaphors will continue to be of utmost importance for the successful implementation of that vision and for the social acceptance and adoption of its services. In this sense, and applying the successful example of the Internet to the AmI, the use of metaphors will be essential to legitimize the new technique, as "[i]*t also affords a set of justifications that enable designers and users alike to explain their engagement in the digital world*" (Flichy & ebrary Inc., 2007, p. 208). As "[t]*he imaginaire is at the center of design and use of the Internet*" (Flichy & ebrary Inc., 2007, p. 208), the imaginaire will also be at the center of design and use of the future AmI.

Moreover, the common approval and recognition of a shared social *imaginaire*, conveyed primarily through metaphors, "enables a society to construct its identity by expressing its expectations for the future" (Flichy & ebrary Inc., 2007, p. 208). This means that metaphors will play a central role not only in the social response to the implementation of the new technologies, but also in guiding the future developments of the latter. By creating a societal identification with the technology in hands[63] (through the use of common accepted metaphors), people will incorporate the new technological advancements in their lives, feeling consequently interested in taking part in its future design and evolution (and thus projecting its expectations for the future).

In addition, the "upcoming" reality to be addressed and interpreted through the metaphorical analytical view is even more complex and multifaceted, as it includes not only the cyberspace (as traditionally conceived) but also the physical world. As "[t]*he marrying of virtual and real worlds creates a rich interaction that interweaves the images and agencies in the real world with those of the imagination and cyberspace*" (Stefik, 1996, p. 263), the AmI scenario constitutes a challenge for metaphors to come, but also a fascinating setting from which to pluck inspiration. In this matter, the features, characteristics, services and new functions of AmI, along with its interactive agents, point to the need of elaborating different metaphors, as well as of providing different perspectives for understanding the emerging

[63] *The study of the technical imaginaire shows that it always has two functions: building the identity of a social group or society, and providing resources that can be reinvested directly in the preparation and implementation of projects*" (Flichy & ebrary Inc., 2007, p. 208).

technologies. In fact, a new set of metaphors is already being coined to reflect the physical design and shape of Ambient Intelligence Spaces, as well as to pave its construction in the future and legitimize its acceptance by society.[64]

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[64] Examples of these new metaphors are the "virtual residence" and the "digital territory", terms coined by the Institute for Prospective Technological Studies – Seville, Spain, within their prospective analysis of the AmI space.

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