Infotechnology: new social forms, digital noometamorphosis and noomorphosis

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The amazing evolution of technology, ruled by information, is an incubator where, to give several specific examples, we have witnessed the birth and development of electronic mail, medical tele-assistance and e-learning, as well as various forms of cyberspatial communication, such as the immensely popular social networks and blogs. Most importantly, it has transformed our way of life, including the mental processes that govern our daily lives and view of the world. This is the result of the *co-evolution of humanity and technology.*

The technological power of infocitizens

Infotechnology users spend an increasing amount of their time in what could be called the *infocity,* which I defined[1] at the end of 2004 as "The informational space where humans in developed societies, through terminals with buttons, keys, screens, passwords and various identifiers, communicate and carry out an increasing portion of their habitual activities and many new ones, converted into signals, symbols, languages and immaterial processes, based on a powerful technological infrastructure with'reticular architecture."

This infocity coexists with the city, though often in conflict with it, complementing, transforming, broadening or replacing it, as the case may be. It depends on technology, our artificial prosthesis, or to put it more radically, the infocity exists in and through the technological prosthesis, from which its power and fragility arise, as well as all of its manifestations. They include blogs,[2] a new section of the repertoire of infocity communication activities, a lively section with its own personality on the Web, a virtual subspace[3] based on a powerful technological infrastructure that becomes more like a Universal Digital Network with each passing day (Sáez Vacas, 2004b). Many people seem to believe that things spontaneously spring into being, and thus, it is worth pointing out that we are discussing the product of a complex sociotechnical and cultural process, with a time sequence of maturation. It serves to take any modern technology from an embryonic infrastructural state to the stage where it is converted into a useful tool, to be subsequently appropriated socially by part of a high number of finjal users. The majority of them are unaware that they are citizens in a space that never existed until now, and possess a great capacity for personal action, as we enter a new social, mental and ethical ecology.

In that process, a leading role has been played by the personal computer, which is the historical instrument comprising the user's power — the user's personal infrastructure par excellence — that has evolved by leaps and bounds. Initially, they were provided with a bare operating system, solely apt for programmers and very technically

skilled users, until, with time, personal computers gained a highly intuitive graphic user interface with many practical applications that made use of the amazing data processing and memory features foreseen by the Moore's famous law of microelectronic progress.

Metamorphosis from professional infotechnology to social "machinery"

Without going into details, today everybody knows that a computer is a universal machine, able to carry out — thanks to the proper *software* — all types of data processing, not only in numerical or calculation fields, as was true of its origins, but also texts, graphics and images, signals, symbols and languages, etc., separately or jointly, forming multiple combinations, capacities that have expanded and been included in all instruments and digital information appliances. The most spectacular example is the digital terminal we take everywhere we go and continue calling a "mobile telephone" out of habit. We have reached the era of technologies for everyday life, which can be abbreviated in Spanish as "TVIC."[4] However, to complete the list of types of processing, an essential point is its capacity to become a node of communication networks, a technological matrix where the definitive step is underway for today's social information revolution. From the perspective of economic sociology, looking back to 40,000 years B.C., Wood (2000) has shown that the developed nations are in the sixth wave (from 1975 to 2010), corresponding to the network revolution, thanks to the convergence of telecommunications, computer science and communication media, which is not, as is often written and stid, limited to the Internet.

A dense fabric of interoperable networks has emerged and is growing. Its structure of nodes formed by computers also includes many devices, including the super abundant telephone, which now incorporates the legacy of multiple information technology features in a one-hundred-grams terminal: email, SMS and MMS messaging, camera, radio, MP3 player, calculator, calendar, clock, Bluetooth and Internet connections, GPS land navigation, etc. In sum, the development of infotechnology has produced a huge social machinery as a combined effect of two historical processes, which can now be summed up with two of their fundamental contributions: a) based on the invention of the personal computer, the development of abundant and varied useful applications for millions of final users in economically developed countries who, with more or less effort, have overcome the digital gap or, due to their youth, never experienced it; *b)* the progress of the connectivity properties of the set of digital devices, that transversally connect all the users, their data, ideas, information, process resources, through new applications for networks and various platforms, with the Web outstanding among them due to its great popularity, the simplest, most universal vehicle for communication and surfing for a huge and highly active reservoir of information.

The leap has been immense. To describe it briefly, the capacity[5] has been transferred from the huge computers in data processing centres of the 1960s and 1980s, governed and operated exclusively by professionals and which users, with no direct access, perceived from the base of the pyramid in a passive relationship, to a desktop or laptop computer, with which those hundreds of millions of users can operate autonomously in communication with other users and their machines, not one on one as a telephone network,

but one to many, or potentially everyone to everyone. Thus, each and every one of the user-nodes would have the capacity to become the centre or a node in one or several of the copious and almost intangible social networks formed in the infocity, with growing dynamism and density, thanks to the development of a broad range of cooperation technologies.[6]

The transformative power of technology has given renewed vigour to the study of social networks, now transmuted into an interdisciplinary field that encompasses anthropology, sociology, social psychology, history, political science, human geography, biology, economics, communications science and other disciplines. The structure of social networks was a widely researched subject in the 1960s, in the wake of much earlier mathematical work on graph theory, but only quite recently has a new science of networks been proposed (Barabási, 2002). I have long thought that the broad notion of "network" has become a truly general conceptual paradigm (Sáez Vacas, 2004a).

A time of social learning and a dense (technological) time

As stated by Winograd and Flores in a book that has yet to be surpassed in its genre: all technological tools are part of a complex social network (Winograd and Flores, 1986); the significance of a new tool lies in how it is incorporated into that network, modifying it; and, to understand a technological tool, it is not enough to gain a functional understanding of how it is used. One must also gain an overall understanding of the technologies and activities involved. And we should add: and of the consequences, which are not always benign and are at times pathological, as can happen when an imbalanced development of the infocify turns humans into "data processors and packages" (Sáez Vacas, 1991).

All the technology of the Internet, or, in a broader sense, of the Universal Digital Network, makes the time of action more intense, denser (a concept described by Rosnay, 1996), or, to state it simply, multiplies the number of each user's activities per unit of real time, a feature that, as just stated, may involve consequences that are not only positive (Sáez Vacas, 2004b: chapter 11) and which, in view of the set of emerging changes, lead us to suggest it might be wise to develop a sociotechnology for the whole set and some technocultural bases suitable for these circumstances (Sáez Vacas, 2008).

In contrast to dense time, social learning of technologies takes place in "longtime" processes (concept proposed by artist Laurie Anderson). Basically, the feats achieved by technology, due to its complexity and because it changes much faster than humans, are not automatically taken into the working and dynamics of social structures. In principle, any complex technological product — let's take email, invented in 1971, as an example — needs to evolve over several generations until, following a maturation process, it achieves, with the experiential aid and contributions of a minority of users some quite technical, others quite enthusiastic and innovative, a sufficient level of usability to reach a broader public. And that significant operative leap, materialized in the social appropriation of dense time, opens the door to an opportunity to develop the changes — that are cultural, political, economic and so on — typical of all historical processes of technological innovation.

It may bear repeating that merely assimilating the operative aspects (in reality, never more than a fraction) of any technology — or tool, if one

prefers — is one thing, but gaining an understanding of its social significance, how it modifies the conditions of our way of life and behaviour in multiple dimensions, and learning to use it efficiently and with common sense, quite another. That is the gist of the second phase of social learning of technology, given that, as biologist Dobzhansky was correct in asserting, "Upon changing the world they live in, humans change themselves." And that cannot be left to improvisation.

Social learning levels are not uniformly distributed among the population of users. Only a minority of trained, aware users — that should include those of us who ask questions, innovate and set patterns for others to follow — will attain a certain familiarity with the concepts and techniques hidden behind the simplified interfaces of socialized technology, or its transforming implications, or the deeper meaning of "the technologies and activities involved", but not, unfortunately, of the three disciplines at the same time. The remaining users, that is, the immense majority, operate more or less automatically, guided by only a bare minimum of functional technicality, similar to that of a driver using áll the buttons, indicators and screens in a car, which are equivalent to the buttons, icons and forms one finds today on platforms to publish and edit blogs. It is only a slight exaggeration to say that all one needs to know is what button to press, where to click, or what menu to bring down with the mouse.

However, if, in addition to our fascination with the ineffable, purely material achievements of technology, we believe it to be an instrument of positive social change, we should reflect with greater attention in our attempt to understand how its features and properties create a general environment that establishes the operative conditions of our activities in the infocity and our relations with nature. I took this advice and wrote a book of my personal reflections (Sáez Vacas, 2004b), focused on the set of digital technologies, and the Universal Digital Network *(la Red Universal Digital) (RUD),* a reticular structure that penetrates into the core of objects and human bodies. The RUD projects away of life onto the human environment comprised of at least twenty transforming conditions and forces, that I call the "New Technosocial Environment", in Spanish *Nuevo Entorno Tecnosocial* (NET), where new social forms in the infocity and a new "culture" are developing, in competition with the classic forms of the city.

That culture is due to a large extent to the digital nature of information, which now encompasses in a sole aspect all the dimensions of multimedia and all known types of processing, and turns them into a universal, repeatable (and therefore inexhaustible) structure that is "infinitely" versatile, able to instantaneously be and move into every part of an open, incommensurable and invisible space (except to the eyes of the technological prosthesis of each node), which theoretically belongs to no one and belongs to us all, in which we are all called to take part.

An "infinitely" versatile universal structure? Solely with respect to access to information, the following paragraph, not to mention the title of the article by Kelly (2005) from which we have excerpted it — "We are the Web" — gives us an idea of that type of versatility:

> Today, at any terminal of the network, you can have access to an amazing variety of musical and audiovisual contents, an encyclopaedia with its own voice, weather forecasts, classified ads, satellite images of any place on Earth, "instant" news from the entire planet,

forms to pay income tax, TV guides, marked highway maps, stock market quotes in real time, telephone numbers, real estate catalogues with virtual views, images of almost anything, sports results, sites to buy practically anything, lists of political contributions, library catalogues, manuals for all kinds of devices, live traffic updates, archives of the major newspapers, and everything organized on an interactive index that really works.

Emerging social forms compared to social forms in decline

The relations between the city and infocity generate a permanent crisis zone in which social learning takes place. This must include facing the creation of new activities and the transference of activities in classic "city mode" to the new environment (Echeverría, 1999), "infocity mode", given that, as we have said, the infocity, where users tend to acquire an increasing functional power, integral to the new technosocial scenario, complements, broadens or replaces the city, which, in other words, means that social forms tend to change. For example, the way journalism is performed, the way things are bought and sold, the ways music is distributed, the ways things are published and managed, how politics are run, ways of educating and learning, how people get their information and news, the ways people commit crimes, etc. As a result, the human organizations that support those activities change. Although history has amply demonstrated that completely opposing the forces of technological innovation is not a winning strategy, it has also shown that it is normal for numerous human organizations, rooted in declining and possibly replaceable forms, tend to resist, or conflicts are produced in areas where chahge is still poorly defined or where there is a loss of certain privileges and consolidated powep of control.

At this point, I would like to make a clarification. In none of the lines of this article have I attempted to identify directly the unquestionable technical power placed in the hands of the infocitizen in this new emerging technosocial environment, with personal or social power, where that means the ability to control or influence others, although I think it is legitimate for other authors and analysts to highlight this characteristic as compared to the other established forms of political, economic and media power of some organizations or, for example, to speak of techno-influencers, in relation to the economy and markets.

However, it is worth pointing out the explosion of forms of collaboration among infocitizens, attributable to technical development. Upon consciously incorporating it into their lives, users can contribute, and many do, to building a more active, more creative infocity where more is share and the flows of exchange are less pyramidal. Kelly (2005) speaks of an emerging culture, based on sharing, including blogs, wikis, open source, P2P, etc. Millions of persons who were formerly merely receptors, have already become very active participants, and some are co-authors or co-producers of various social networks, frequently with no personal economic gain; according to a study quoted by Kelly, only 40% of the Web is commercial.

A subject for debate: the impact of digital technology on our mental processes

Earlier, we referred to the need to try to understand how the features and properties of infotechnology create a general environment

that determines the operative conditions of our activities in the infocity. Now, we must extend the understanding of that impact to our cognitive and emotional processes. Infotechnology, directly or indirectly, can be considered a knowledge tool and therefore, a tool for intelligence and culture. As explained by R. Simone, it influences how our brain handles information, how information is received and processed, how it transforms the capacity and weight of our senses in the formation of knowledge, and how it activates new modules or functions of the mind (Simone, 2001).

A lack of space prevents me from offering a detailed description of this highly significant matter in terms of the social and personal relations in life without defined borders between the city and infocity, a subject of great importance to education, which is why I will end with an overview of two aspects referring to possible changes in the structure , and dynamics of mental processes.

One is particularly related to children who have been called "digital natives", given their intense early immersion in the increasingly dense and extensive infostructure we are calling the *Universal Digital Network.* In 2006 on a blog, I proposed the hypothesis of the "change in mental structures and therefore, in the very form of intelligence of a rapidly growing number of our kids", a phenomenon that, based on the Greek etymology *(noos,* 'intelligence', and *morphosis,* 'formation'), I christened as *digital noomorphosis,* which means 'formation of intelligence' (Sáez Vacas, 2006).

If social observations and neuroscience experiments confirm this hypothesis, human relations, education, political and economic organization, communications, the very concept of "human being", etc. y/ill undergo a radical shift, given that intelligence is the true measure of a human being. Digital noomorphosis is where the real, huge dimension of the digital divide is hidden, a concep that we have handled to date with extreme superfi ciality, if we assign the true value to its connection with a new social, mental and ethical ecology.

It is not that the intensive use of RUD technology may contribute to moulding greater or lesser intelligence — for example, to making children cleverer, as some say — but that it results in a functionally different kind of intelligence, that is, equipped with specially developed capacities to live and operate in a newtechnosocial environment (NET, in its Spanish acronym) generated by that technology. Given what we know today about intelligence, the habitual discourse about IQ (intel ligence quotient) to quantify it no loner serves in emerging situations, which is why some say that it will not be long before IQ may become practically a relic, like so many other social forms in decline, including educational systems. Logically, digital natives tend to be the natural inhabitants o the infocity, which is why they will potentially be equipped with many of the capacities suited to the immaterial processes that are typical of it.

To complete the picture and not restrict ourselves to children or new generations, the second aspect we need to reflect on is the influence of infotechnology on the minds of "digital immigrants", that is, adults of all ages who have to adapt to spending part of their time living in what — for them — is unknown: the infocity. Naturally, their minds also adapt, as suggested by several example from everyday life, compatible with the feature of brain plasticity. Recently, a media debate arose based on a text by Nicholas Carr, in which he confesses that the intense use over the span of a decad of the Internet in general and on Google's search engine in particular are causing him "the uncomfortable sensation that someone or something has been playing with my brain, changing the layout o

its neural circuits, reprogramming my memory"; in a word, changing his thought processes. To name this type of transformation (metamorphosis), I created the term "digital noometamorphosis" (Sáez Vacas, 2008).

There is work here for neuroscientists, for although Carr titled his text "Is Google Making Us Stupid?",[8] it is already possible to quote professor Gary Small of the Semel Institute for Neuroscience and Human Behavior at UCLA (University of California, Los Angeles), who, in contrast, through recent experiments with mature and elderly adults, has shown the positive influence of search processes on the Internet on the decision-making and complex reasoning functions of the brain.[9] Dr. Small has also written a book titled *Ibrain: Surviving the Technological Alteration of the Modern Mind.*

All of these effects, still not understood to a large extent, are some of the results of the historical process of the "co-evolution of humanity and technology."

Notes

1 "Ya portamos en nosotros los terminales de la infociudad", lecture at the International Congress on Digital Culture and Citizenship, Universidad Autónoma de Madrid, 15-19 November, 2004.

2I coordinated a monographic collection of nine articles on this subject, published under Creative Commons licence, in the journal *TELOS* (Sácz Vacas, 2005).

3 In an interview published by the newspaper *El Mundo*, 3-12-2004, Tim Berners-Lee, the inventor of the World Wide Web, defined it as "a collaboration space in which to communicate and share information." In this article, we have called it a *subspace,* with reference to the total space comprising the information provided by the Internet and the Universal Digital Network in general.

4 Acronym proposed by the author (Sácz Vacas, 2007).

5 Recent technical data from official reports issued by the U.S. Semiconductor Industry Association show that an electronic memory chip has an approximate capacity of 75 Mbytes, included in a small square of 310 square millimetres and the microprocessor of the most recent generation of personal computers can execute several hundred million machine instructions per second.

6 On this subject, see reports SR-897 *Technologies <jf Cooperati* or *The Cooperation Project: Objectives, Accomplishments, and Proposals,* at <http://www.iftf.org>, the web site of the Institute for the Future, in Palo Alto (California).

7 Transformations or barriers classified in five space-time dimensions: a) transformations; b) transformations in the body itself, sensory relations, in the limits of personal action and in identity c) transformations toward a unified language for data capture a processing methods; *d)* transformations in hierarchies of intellectual relations with the technological environment and object e) barriers in relations between users and technology (Sácz Va 2004b: chap. 10).

8 N. Carr, *The Atlantic,* <http://www.theatlantic.com/doc/200807/google>.

9 See R. Champeau, "UCLA Study Finds that Searching the Internet Increases Brain Function", <http://www.newsroom.u edu/portal/ucla/ucla-study-finds-that-searching-64348.aspx>.

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