Revista d'Etnologia de Catalunya _ Juny 2015 _ Núm. 40

Artur Serra Hurtado

i2CAT Foundation
BARCELONA_CATALONIA

He has a PhD in Cultural Anthropology by the University of Barcelona (1992). His interests focus on the construction of techno-anthropology as a new science of design, devoted to understanding and designing new cultural models emergent from knowledge society

Communities of Knowledge and Information

Techno-anthropology Work as a New Science of Design

In 1999 the *Journal of Ethnology of Catalonia* published a monograph on the Cultures in Cyberspace, headed by Dr. Buxó. In this issue, a number of anthropologists explain our visions on the cultures of cyberspace. Now, after a decade it seems that this generation of anthropologists have matured and want to open a new field of research and innovation called technoanthropology.

La *Revista d'Etnologia de Catalunya* va dedicar un dossier coordinat per M. Jesús Buxó l'any 1999 al Ciberespai. En aquell número, un conjunt d'antropòlegs vàrem explicar les nostres visions i els estudis sobre cultures del ciberespai. Després d'una dècada sembla que aquesta generació d'antropòlegs hem anat madurant i volem obrir un nou camp de recerca i innovació que anomenem tecnoantropologia.

Keywords: Techno-anthropology, computer scientists, cultural design, living lab, Citilab

Paraules clau: Tecnoantropologia, informàtics, disseny cultural, "Living lab", "Citilab"

As an anthropologist that started out in the discipline by analysing the culture of computer scientists, techno-anthropology could be a new branch of what are known as the sciences of design (H. Simon), like computer science itself. While computer science is aimed at understanding possible new models for computers and their construction, techno-anthropology is dedicated to the design of possible new human communities and their construction in the form of experimental communities or communities of innovation. While the traditional work of anthropologists is based on the ethnography of existing communities, techno-anthropologists' work includes these ethnographies within a broader design, construction and validation of new cultural models. At present, that means assisting processes of cultural change in communities of knowledge and innovation.

Techno-anthropology is distinguished from the various fields of Internet and cyberspace anthropology and sociology, etc., which simply apply the traditional ethnographic tools to the study and understanding of the different current digital communities (social networks, etc.) or the so-called impacts of new technologies on society. Just as computer scientists are not simply involved in the study of computers in existence, but also in designing new ones, techno-anthropologists are not limited to being participating observers or conducting fieldwork and like all technologists, strive to design for the community. As computer science professor Juri Artmanis said: "We can say that in physical sciences we are primarily interested in the existing and in computer science (or the new species of the sciences of which there surely will be more). We are primarily concerned with that which is possible, with what can exist" (Traub, 1981: 354).

The work of techno-anthropologists includes assisting processes of cultural change in current communities of knowledge and innovation. CITILAB

Unlike computer science, techno-anthropology deals not so much with designing new computer architectures or possible new digital networks, but feasible new human communities that could also make new technological leaps forward as mechanisms for their development.

Following the idea suggested by cognitive anthropologist Roy d'Andrade, who saw cultures as cultural programmes (Andrade, 1989), techno-anthropology could be the science of design and of cultural programming. Andrade outlined the idea of cultural models as a basis for his view of human cognition. According to him, "The study of cultural cognition then is the study of cultural information and cultural programs that interact with the more general programs of intelligent systems" (1989: 825). His approach was based on the concept of the cultural model, which he defined as "a cognitive schema that is intersubjectively shared by a social group" (1989: 809). Techno-anthropology could be the science for designing potential new cognitive schema and validating them through their experimental construction.

A Brief History of the Sciences of Design

The first Computer Science Department was founded at Stanford University in 1964, but the origin of this first science of design was much earlier. In fact, it seems that this type of science emerged from previous innovation. The Second World War forced the scientific community of the United States to turn to engineering and devote itself to designing a series of radically new artefacts never before dreamed up by any engineer, like atomic bombs, electronic computers and programming languages.

Years later, some leaders of this community that had returned to the academic world and maintained links with government research agencies proposed that the agencies develop their inventions further with research programmes. These research programmes are what gave rise to the new sciences, like what was at first called information processing and later became known as computer science. The transformation of scientists into techno-scientists or scientists of design is key to understanding the emergence of biotechnology, nanotechnology and different areas of computer-inspired research that form the foundations of knowledge in the digital age.

Like computer science, these sciences were created from a synthesis of scientific and engineering knowledge (in the words of Allen Newell, "putting it all together"). Thus, from the beginning, computer science was created by electronic engineers, physicists and applied mathematicians. Individual social scientists also collaborated from the start, like Herbert Simon, who together with mathematicians like A. Newell invented Logic Theorist and artificial intelligence along with it in 1955. It is a little known fact that J. Licklider, the first director of the ARPANET Information Processing Office, was both a human factor psychologist and a computer scientist. It was he who came up with the concept of the Galactic Network, the 1960s-era precursor to the Internet, as a symbiotic man-computer system. Facebook and Twitter are more recent products of his legacy.

The last 50 years have been the golden age of ICT research. This has marked the way that social scientists have collaborated with computer science: we have set out to design better and smarter computing systems. This research has flooded our society with an ocean of digital networks and devices of all kinds, and we are very proud of it. But having reached this point, we are starting to see clear limits to the research. The financial crisis that broke out on Wall Street in September 2007 has shown that even though the world is full of digital artefacts and the Internet has connected two billion people in little over 15 years, our systems

Revista d'Etnologia de Catalunya _ Juny 2015 _ Núm. 40

of knowledge, values and customs are hardly any different than they were at the start of the Great Depression in 1929.

It is clear that digital technology is a fundamental change with regard to industrial technologies, but by themselves they have not been able to change the cultural model of our societies, which is still the same as it was 100 or 200 years ago. In technological terms, we live in the world of the Internet, but in economic and social terms we still live in the world of M. Weber and his Protestant work ethic and capitalist spirit. The universal spread of these values, now under an emerging productive neo-Confucian China, not only remains unchanged, but is a display of its global success. Just as occurred in the West in the last two centuries, the expansion of these values is necessary for overcoming poverty, fighting hunger and extending the life expectancy of most of the world's population in the 21st century, a goal that we can reach if we reconcile the desire for growth with sustainability.

What is no longer so clear is whether the part of humankind that has already fulfilled this dream in the past should continue along the path that sentences us to certain (though comfortable and sweet) decadence. Therefore, we urgently need to explore new cultural models that enable us to open new paths of civilisation before it is too late. We may agree with Karl Popper that "today's world is the best of all the worlds we have known", but we do not agree that other societies better than our current one are impossible, while understanding that the term *better* is relative to each culture. Other worlds have been possible in the past and will be so in the future. We also hope that they may be better. With that hope in mind, this could serve as an initial working hypothesis for techno-anthropology.

Cultural Designs: Living Labs

One of the advantages of living in Europe is the early experience of processes that come to other countries that follow a European cultural model decades or centuries later. Europeans have moved from the centre to the periphery of modern society established since the 15th century. This historical decline has become evident since the Second World War, when the best European minds emigrated to the United States and helped that country to set up some of what would later come to be known as new technologies.

Alan Turing and John von Neumann were Europeans and are considered the fathers of computer science in the United States. While the United States was putting the electronic computer to use, Europe was being rebuilt as a union of coal and steel (!). For decades, we strove to remain connected to modern society and its developments. Without abandoning this effort, we propose opening a new experimental programme of new cultural and social models: a programme that helps us to rethink values, reinvent cultural practices and become a continent of possibilities once again. At the end of the Middle Ages, Europe underwent a series of catastrophes (plague, war, etc.) that finally gave rise to the Renaissance. The solution lay not in holding on to the old feudal cultural model, but in adopting the construction of a new type of society and culture. Instead of yearning for what we no longer are, we could start to design what we might end up being. Thus, the intellectual effort of techno-anthropology, originating in Europe but open to the world, could help to determine this possible future.

> **THE DIGITAL WORLD IS A PRIME AGENT IN CHANGING LIFESTYLES, THOUGH IT STILL HAS TO FACE OTHER KINDS OF RESISTANCE**

One of the first values that must be reconsidered is the value of innovation. In today's society, which is focused on economic values, the creation of wealth through work is the main goal to which all other human values are subordinated. Economists are increasingly beginning to admit that the creation of new knowledge in the form of R&D&I (research, development and innovation) is a component with rising importance for creating value. By going deeper into this line of argument, could we reach a turning point? In other words, do the means become the ends, and vice-versa? Could we reach a point where the essential activity of society would be the generation of new knowledge and not work or entrepreneurial activity? So far, innovation has provided assistance to capital and work. But would we not have much more capital and jobs if innovation were the very heart of social and economic activity? This is what the first Protestants did: they changed their values. Instead of working to live, as was habitual in mediaeval societies, they claimed that it was better to live to work and to produce. Might we venture to think that instead of innovating for the business word, we should work to innovate?

One study indicating this possible change in the scale of values within pioneering computer communities was conducted by techno-anthropologist Pau Contreras (2004) in his book *Me llamo Kohfam*, which clearly lays out hacker ethics and the key distinctions between them and Protestant ethics. Based on the production of new innovative knowledge, this code was already clear in the study of the community of computer scientists at Carnegie Mellon University (CMU) (Serra, 1992), but the difference here is that Contreras

analyses an independent community of hackers that do not make a living professionally as researchers in an R&D&I system. A hacker may be any computer user simply described as such by his or her peers. Himannen (2002) had also written earlier how the logic of hackers differed from Protestant ethics.

The problem lies in how to generalise this cultural pattern to the population at large. For the time being, hackers could be compared to the role played by reformist sects in the late Middle Ages prior to the Protestant Reformation, when they were crushed by the combined action of the aristocracy and Rome.

THE CONTINUOUS CREATION OF KNOWLEDGE IN ITSELF BECOMES ONE OF THE FEATURES OF THE DIGITAL SOCIETY

One step forward in the generalisation of this cultural model is found in what are called living labs. A result of awareness about European slowness and the crisis in its system of innovation, new types of social structures called living labs or open laboratories have recently been emerging that attempt to connect the official system of innovation to users' and people's demands. First created in 2006 by the Finnish government and research and innovation community, this new type of institution aims to open what has so far been a closed and elitist R&D&I system to everyone, and not just in terms of designing new technological services and products, but in the field of social innovation as well. One of the primary aims of these living labs is to open processes of learning and innovation. "You Can Learn to Innovate" is one of the mottos of the Second Summer School planned for the summer of 2011 in Barcelona.

Modern society is based on universal literacy. At one point during our economic development, industry required overcoming illiteracy and extending reading and writing skills to the entire population. As the system evolved, the educational requirements of this model deepened, which had been invented by the Greeks and called the trivium and quadrivium by the Romans. After the Second World War, the most advanced countries even generalised initial university education (*bachelor's degree*) for all school-age youth.

However, due to its very origin, the system suffers from a chronic lack of people trained in technology. In the past, liberal education looked down on mechanical work and modern society continues to do so. The humanist education boasted by prestigious American universities such as Harvard and the Ivy League club left out MIT and its engineers, deemed unworthy of joining the group of institutions that groomed senior government officials and financial leaders. This educational model still prevails in the world's leading educational power. So far, the gap has been filled by importing young engineers from emerging countries, but as these countries develop, it is no longer seen as mended. This structural gap in modern educational systems is found primarily in Western countries, but also in the rest of the world: technology is being used, but people do not want to learn about it.

"You Can Learn to Innovate"

This educational gap also leads to a lack of employees to keep the R&D&I system running. People do not know how to innovate. We buy innovation, we use innovation, but we do not innovate. The R&D&I systems that arose in the wake of the Second World War, due to the imperative need for nations to invest in science and technology as a single unit, are new. If we compare them with other social systems, like the health system and educational system, we see that even though developed countries devote nearly 3% of their GDP to R&D, current systems for generating knowledge are the most recent part of our current systems and are still under development. If we analyse the part of R&D&I strictly devoted to ICTs in these systems, we see that it is only a small part of the entire science and technology system in the most advanced countries. And if we include investigation into new structures of the information society in ICT research, the amount drops to almost absurd levels.

LIVING LABS ARE ESSENTIAL TOOLS FOR STIMULATING INNOVATION

Let us return to the educational system. It is still believed that using computers and the Internet ensures that we have entered the digital age. In reality, educating people in these new technologies is a big unresolved problem in all countries. The very agreement between teachers and educators that ICTs are "a tool for education" also presents the greatest obstacle to understanding the problem. The Internet has gone from connecting a few million scientists and technologists to connecting billions of people. So what? Imagine that we already have seven or nine billion people connected through Facebook. So what?

Connectivity alone does not create a better social order or more productivity. What does emerge as a new challenge is whether it is possible to boost the ability to innovate among people, young people, older people and communities. We are still far from understand-

Revista d'Etnologia de Catalunya _ Juny 2015 _ Núm. 40

ing that one of the most important cultural changes may lie in producing innovation and research on new technologies in today's laboratories and sending the results to schools, factories, parliamentary bodies and daily life, among other destinations. Perhaps the cultural change that we are beginning to glimpse is turning growing sectors of our social life into laboratories. And these are not just laboratories for making mechanical devices, but places for social, economic, cultural and other types of innovation.

One of these laboratories could be schools themselves. Beyond the trivium and quadrivium, we could create an educational quintivium that does not only teach reading and writing or the four rules of arithmetic and calculation, but also problem-solving, the concept of the algorithm, networks programming languages, love for technology and the human, animal, artificial and design-related aspects of culture. Technology is still a neglected subject in school. Experts in education repeat insistently that it is just a *tool*. And? Natural language is also a tool. We will not advance until we understand that technology is the gateway to a new cultural model. In addition to learning how to remember and understand, we need to learn how to innovate. And to a certain extent, techno-anthropologists can propose and facilitate this cultural change.

Some American schools are taking a step in the right direction by introducing computational thinking in lieu of traditional computer classes. This entails teaching all primary and secondary students basic computing concepts (algorithms, complexity, iteration, etc.). In this sense, the Computer Science Teachers Association (CSTA) in the United States has developed a curriculum for K-12 students (CSTA, 2005).

Designing the i2CAT project

We propose that the practice of techno-anthropology could lead to cultural innovation, the design of new community artefacts that favour cultural change and validate the hypotheses of earlier work. Unfortunately, there are not many anthropologists interested in innovation. We have only found one anthropologist in the history of the discipline that has published a book on the subject. His name is Homer Barnett, and in 1953 he wrote *Innovation, the basis of cultural change*, which among other things relates his experience as an applied anthropologist in the Pacific theatre during the Second World War.

Changes of all kinds in our society nowq have one of their best tools in cultural innovation. CITILAB

My own techno-anthropological practice began with the study of the computer science community at Carnegie Mellon University (CMU) in 1990-93. Though it was still a classic ethnographic study of a community, in this case it was a community of university-level *computer scientists* at CMU, who recognised the value of design and innovation in their established cultural code. I understand that techno-anthropology includes ethnography, but this occurs within a broader programme of research aimed at designing and building new communities and/or organisations that embody the values of design and innovation that we propose. I began this design work upon my return from the United States, first at a public company, the Centre Divulgador de la Informàtica (CDI) led by Santiago Guillén, who was key in funding the research performed at CMU, and later at the Universitat Politècnica de Catalunya (UPC). At the CDI, I designed a workshop in 1994 called Telematic Technology Transfer (TTT) that demonstrated that it was possible to use the Internet to encourage innovation and technology transfer to SMEs. The UPC later hired me to work on the European COMIC project as an ethnographer to analyse cooperative working practices in a network, which I did with the study of the I*EARN network. With the COMIC project, I saw that it was possible to have at least one anthropologist at a purely technological university.

What I discovered was that the work to analyse innovative social practices like those developed at I*EARN was not enough. I wanted to experiment whether it was possible to generate new social structures for research and innovation. The first was the proposal to create the Internet application cen-

tre CANET in 1997 and the second was the idea to create the first research programme on the Next Internet Generation in Catalonia in 1999, which brought together various academic research and business groups and members of government for the first time and gave rise to the creation of the i2CAT Foundation in 2003. In 2009, Esteve Almirall published the i2CAT Foundation's first study as a living lab (Almirall, 2009). More recently, Jordi Colobrans began a techno-anthropological line of work at the i2CAT Foundation based on different clusters such as eHealth and the Media.

Essentially, what first the project and now the i2CAT Foundation have proven is that new research communities may be designed within the Internet world and that techno-anthropology may help ICT engineers to find new lines of research and innovation,

TECHNO-ANTHROPOLOGY CONTRIBUTES TO RESEARCH AND INNOVATIVE CREATION, LIKE THE CONCEPT OF THE CULTURAL INTERNET

such as the audiovisual or cultural Internet, which are better adapted to our social and economic surroundings, new models of cooperation with companies, institutions and people, a more international dimension to their research and an opening of the role of technologists and technology universities in their countries.

It is obvious that cultural design can never be done alone, especially when possessing knowledge of human beings. Much of its success owes to design appearing and being appropriated by as many people as possible, even if this drowns out the conceptual work of those who began it. It is very important for cultural designers to understand that writing the score is one thing, but conducting the orchestra is another entirely. I advise future designers to truly keep this idea in mind and to limit their role to providing inspiration or composing scores and to leave conducting to other people, or else participate in it in a non-significant way.

Cultural Design and the General Population: Citilab

Europe is a continent of small and medium-sized cities and of citizens, if you compare them with the metropolises of the 21st century. From here emerged the chance to design a centre of innovation on a local scale that we finally called Citilab, in the city of Cornellà de Llobregat. The original proposal was submitted to City Council in 2002 and the centre opened in November 2007. The experiments invite us to try it on a small scale. Here we see Karl Popper fully vindicated with his *piecemeal social engineering*. This is what we can do in Europe today: new experiments. As we know, there are not so many Europeans, and even less are Catalans. What can we do in a world dominated by powers with billions of people? But let us not forget: being small, independent and living close to the sea is what enabled the rise of the democratic systems in Greece two thousand years ago. *Homo habilis* also must have been a small group compared to the other hominids at the time. Innovation normally begins in small groups. This must be due to the high degree of risk involved.

Citilab is based on a previous civic network programme lasting several years. As an anthropologist as part of the UPC, I had a wide berth to begin a programme to promote Internet access among different groups of people in 1995: TV Nou Barris, with Miquel Sánchez at the fore, and the group TEB of the Raval. From here came Nou Barris Net and RavalNet. For years, I tried to set up coordination among the different civic networks in Barcelona and formed BCNet, but my efforts ended in failure. One of the reasons was my inability to convince Barcelona City Council that they were not the city of Barcelona, but merely its government. And the civic networks were proof of this. I think this is what ended up convincing them not to support it, unlike the group of innovators of Tarragona that managed to create TINET. With the support of V. Badenes, director of CornellaNet, they organised the first world congress on civic networks in autumn of 2000. The aim was to learn about other experiences from around the world and see how everyone can connect to the Internet facilitating access and digital literacy. What they found was that these goals exhausted themselves and that a world where everyone is connected does not necessarily make for a society of innovation. So what could be the next step to take? Just as they had visualised a second Internet generation, might a next generation of the knowledge society not emerge? What could its objectives be? Simply being connected? Learning to send electronic messages or browsing the Internet? The next challenge could be building capacities for all to generate knowledge and innovation, turning the city into a lab, with the general public creating and participating in a lab. This theory of design gave rise to Citilab, the first civic laboratory, in 2002. Along the way, we discovered the emerging European living labs network, which argues for the initial idea that inspired us, and linked up with them.

Revista d'Etnologia de Catalunya _ Juny 2015 _ Núm. 40

If anything has inspired me –and continues to inspire me– during the last few years as a techno-anthropologist, it was the idea of a project. While traditional anthropologists start and end their work with an ethnographic study, techno-anthropologists start and end their work with a cultural project or cultural design, which must include ethnographic analysis as well. While the former have enough work to do just to understand what the cultural patterns and institutions of a given community are and how they operate, the latter endeavour to design communities that very often do not yet exist, implement it and thereby verify whether or not the society potentially designed is possible.

For me, the idea of a project is what structures all my work as a techno-anthropologist. The concept has always fascinated me. Back when I studied at the Faculty of Philosophy and Letters at the University of Valencia in the 1970s, I used to wonder why science and humanities students had to finish with theses and papers while engineers were allowed to submit final projects and to design and invent things.

That idea has followed me around my entire life. Why did we have to limit ourselves to analysis while architects and engineers designed and built? Until I discovered the work of Herbert Simon, I did not understand that social scientists could be scientists of design without becoming politicians. Max Weber's distinction between the scientist and the politician had been overcome.

But I still needed to find the right time, and it came in an offer from the UPC, when they hired me as a social scientist for Manel Medina and Leandro Navarro's team at the Department of Computer Architecture in 1995. Could I demonstrate that a social scientist could design a new cultural programme and a new associative structure to carry it out?

The first step in any cultural design project is to see the opportunity, the possibility of a new organisation for certain aims or purposes that give meaning to the ethnographic work. In the case of the i2CAT project, opportunity came with the emergence of a new research programme about the next Internet generation in the late 1990s. The very success of the Internet marked the beginning of much-needed renovation that began at US research universities in the form of the Internet2 consortium, which had not yet come to Europe. After the new chapter of the Internet Society and a small discussion group that brought together many Internet pioneers in Catalonia were organised, a document entitled *Internet and Catalonia: civil society and the next Internet generation* was published on 5 May 1998, which among other initiatives raised creating a research and innovation programme on this subject in Catalonia. Ethnographic work in the region went on for a full year to identify social groups that could be interested in being part of the programme. Finally, a year later, the project was signed at the Palau de la Generalitat, but the i2CAT Foundation was not officially created until three years later.

THE DESIGN OF NEW COMMUNITIES IS ONE OF THE MOST PROMINENT RESULTS SO FAR FROM ETHNOGRAPHIC RESEARCH IN THE DIGITAL WORLD

New communities usually start out with a project. In communities of innovation, the project plays the same role that myths do in primitive societies and that declarations of natural rights do in modern ones. The founding documents in new communities are usually research and innovation proposals or projects. For the i2CAT project, it was an agreement that detailed what research and innovation projects were planned for development and the structure of participating institutions implementing it. But here we insist that the cultural programme is the basis for a new cultural model. As I saw when I was a participating observer at CMU, well before computer scientists started to write a single line of code, they had to write a computer programme and they had to write a *proposal* in which they told the federal agency about the new goals they wanted to achieve (innovative claims) and the human and financial resources they thought they would need to do so. Thus, they were performing a bit of cultural design.

The Cultural Ring and Techno-anthropology in Catalonia

As an anthropologist, I was responsible for printing out a dynamic for the i2CAT project closely connected to the situation in Catalonia. One of the most serious problems facing European and Catalan universities is their disconnect from the society and the economic fabric of the country. This has had the advantage of moving forward lines of research in universities more connected to what the European programme requires than to local needs. The disadvantage is that it places the social dynamic outside university research. Instead of just being a project about networks with European funding as was usually the case, from the start i2CAT tried to connect the UPC and all its ICT potential to other political, business and social entities of the country and to force a local line of funding. Thus, from the beginning it

was organised into thematic clusters that corresponded to the major challenges facing the country: language and culture, linked to the launch of Televisió de Catalunya (TVC) and all it entailed; and the health and education sectors, where Catalonia has historically excelled and played a leading role in Spain. The commitment to an audiovisual and cultural Internet has partially been confirmed. From the launch of the Òpera Oberta project in December 2001 to acceptance of the Cultural Ring by the Catalan Ministry of Culture in 2010, cultural design efforts in the Catalan cultural community have been continuous (Font, 2010).

One argument that has played in favour of this effort is that far from being opposed to technology, a techno-anthropologist may be just as much or more of a technologist than engineers themselves. The entry of the world of art and culture in Internet projects promoted the creation of audiovisual technology and its use in digital networks. As a result, engineers saw that an opera used much more bandwidth than the databases of physics or molecular biology that they had transmitted thus far. The technological requirements that artists could impose on technologists were much greater than those for scientists. Furthermore, the directors of the Liceu would discover that 19th-century art could be combined with new technologies in its most advanced expression. A new programme of collaboration between art, culture and the Internet was opened that a techno-anthropologist had helped to create. ■

Tunisia: Popular Revolt and the Internet

The popular uprising in Tunisia was triggered by the death of a computer scientist, Mohamed Bouazizi. Young people, who drove the revolt, used social media (Facebook, Twitter) and video websites like YouTube. A new service called TuniLeaks was created to report corruption in the country. In 1996, one of the first projects that I organised at the UPC was the first meeting of Internet-users in the Mediterranean, called the InterMed Network (Navarro *et al*., 1996). Tunisian representatives participated in it. After years of silence, it seems like a new era is beginning in the country where the people and new technologies work hand-in-hand.

The Arab uprisings were coordinated through the Internet and social media. GETTY IMAGES

BIBLIOGRAPHY

Almirall, E. *Understanding innovation as evolutionary co-creative process* [en línia]. ESADE. Docto-ral Dissertation, 2009. http://www.tesisenxarxa.net/TDX-1124109-130209/index.html

Barnet, H. *Innovation, the basis of cultural change*. New York: McGraw-Hill Company, 1953.

CESTA (2005). *Final Report of the ACM K-12 Task Force Curriculum Committee* [en línia]. http://csta.acm.org/Curriculum/sub/ACMK12CSModel.html

Contreras, P. *Me llamo Kohfam, identidad hacker: una aproximación antropológica*. III Premio de Ensayo Eusebi Colomer de la Fundacion EPSoN. Barcelona: Editorial Gedisa, 2004.

D'Andrade, R. G. «Cultural Cog-nition». A: M.I. Posner (ed.) *Foundations of Cognitive Science*, p. 795-830. Cambridge: MIT Press, 1989.

Font, J. «L'Anella Cultural. Una xarxa d'equipaments culturals connectats en banda ampla». *Revista Cultura: La Cultura en l'Era Digital*, núm. 7, p. 154-164. Barcelona: Departament de Cultura i Mitjans de Comunicació, 2010.

Himanen, P. [et al.]. *La ética del hacker y el espíritu de la era de la información*. Editorial Destino, 2002.

Navarro, L.; Rodríguez, G.; Serra. A. (1996) *The InterMed Network: Changing Cultural Patterns with a Large-Scale Cooperative Internet Network in the Mediterranean* http://www.isoc.org/inet96/proceedings/e7/e7_2.htm

Serra, A. *Design Culture (Estudio etnográfico de los proyectos de investigación de la School of Computer Science de Carnegie Mellon University, un computer-intensive campus norteamericano)*. Tesi pre-sentada al Departament d'Antropo-logia Cultural i Història d'Amèrica i Àfrica. Universitat de Barcelona, 1992. http://people.ac.upc.edu/artur/CMUdesignculture.htm

Simon, H. A. *The Sciences of the Artificial*. Cambridge: MIT Press, 1970.

Traub, J. F. «Quo Vadimus: Com-puter Science in a Decade». *Communications of the ACM* (juny 1981), vol. 24, núm. 6, p. 351-358. http://portal.acm.org/citation.cfm?id=358677

Article originally published in Catalan in **Revista d'Etnologia de Catalunya (no.38. year 2012)** under the title **Comunitats de coneixement i informació. Tasques de la tecnoantropologia com a nova ciència del disseny**