Chapter 9
Lessons from the Digital Divide

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9.1 Introduction

Attention to the digital divide arose at the second half of the 1990s when two different phenomena began to be remarked, highlighted and commented by a wide variety of authors and institutions, through many reports and scholarly publications. On one hand, the uneven diffusion of computer resources and, more specifically, of Internet access, both globally across countries and within nations, and, on the other, the increasing importance of a new and emerging social structure, often named as the *network society* or the *information society*, linked to the development and implementation of ICT, with profound consequences for the economy, culture, politics and social interaction.

Why was the digital divide considered to be an important phenomenon? First of all, because early surveys showed a very specific pattern for most Internet users: a great majority of them were disproportionally wealthy, male, white and, better educated when compared with standard demographic data. Secondly, because the social consequences of the divide were thought to produce severe inequalities in the near future. As many authors put it, the digital divide "is about the gap between individuals and societies *that have the resources* to participate in the information era and those that do not" (Chen and Wellman 2005: 486).

The digital divide has been thought to mean exclusion from the so-called knowledge economy and that holds and bears serious consequences for individuals, social groups and whole nations. The main consequence of not being able to access ICT and the Internet is basically a lower level of participation in the most relevant fields of society. For people, being in the wrong side of the digital divide may entail difficulties in getting jobs, seeking information, accessing public services or participating in political activities. Access to the Internet can also

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facilitate re-defining careers, accessing continuous educations and, in general, encourage personal growth and wellbeing.

In an information society, information is considered to be a *primary good*. That means it is crucial for the survival and well being of individuals and cannot be exchanged for other goods. Information has also been considered an essential source of productivity and power (Castells 2001: 241). All in all, traditional social differences in economic resources, capital and power seem to be actually amplified when access and use of digital technology is added.

Information has also been conceptualized as a *positional good*. That means that different positions in society might entail better conditions for accessing, processing and using information. In a network society, the position social actors have in networks of exchange and information can thus increase or dramatically decrease their relative power and their survival.

9.2 The Digital Divide as a Persistent Reality

The Internet has spread around the globe since 1998 following a raw exponential rate. The total number of Internet users in the world has surged from 900,000 people in 1993, 360 million in 2000, to more than 2.267 million in 2011 (Internet World Stats 2011). However, widespread diffusion does not mean ubiquity.

In more recent times, the digital divide is sometimes presented as something belonging to the past: as if the digital divide was now small and diminishing and thus becoming increasingly irrelevant. In fact, the digital divide seems not to be a hot topic anymore and has slightly lost interest and significance in academic as well as in policy circles (Chen and Wellman 2005: 467). This declining attention is partly caused by the fact that in most developed countries, the spread of Internet access and use has achieved a great majority of the population. The penetration rate in Europe is 61.3 % and in North America has raised until 78.6 %.

However, if we take into account data for all countries and the whole world population, the digital divide has not disappeared at all nor has it diminished to negligible levels—quite on the contrary. Nowadays—December of 2011—in Africa, the penetration rate is 13.5 % and in Asia 26.2 %. The world penetration rate is now about 33 % and that means a vast majority of world population are not Internet users.

When national rates are considered, the differences are even more acute. The digital divide has not certainly vanished. In a study of the role of income inequality in a multivariate cross-national analysis of the digital divide, (Fuchs 2009) comes to the conclusion that "it is unlikely that the digital divide will be closing as long as there is a high degree of global inequality and high degrees of national inequality in many countries" (p. 54). The uneven diffusion of the Internet still persists around the globe—not only between developed and developing countries but even within developed nations. As we will see later in some aspects, it is still growing.

9.3 Digital Divide and Social Inequities

The digital divide, that is, inequalities in access and use of ICT and the Internet, takes place within a much broader spectrum of social inequalities: international and intranational socioeconomic differences, cultural diversity, educational disparities, etc. Much of the academic study of the digital divide has been addressed to measure the influence and correlation between all these sources of social differentiation and those reflected in the digital gap. The literature has identified several elements affecting the digital divide for individuals. The most influential seem to be socioeconomic status, gender, life stage, ethnicity and geographic location (mainly on the rural/urban dichotomy).

Income is the most important singular factor affecting social access to the Internet (Fuchs 2009). Higher-income people are much more likely to be computer and Internet uses than low-income people. Some estimates show that within countries, the inequalities of Internet access are likely to be twice as high as inequalities in income. The level of education has also been identified as another crucial element, since Internet users show a higher level of training through formal educational institutions.

Socioeconomic status is thus the most basic source of inequality for the digital divide—being income and education the most important factors within this category. Internet users are, in general, better educated than non-users and tend to have higher salaries. The socioeconomic influence in the divide seems to be more important for countries with lower rates of Internet penetration: there the differences between users and non-users correlate with greater income and educational inequalities (Chen and Wellman 2005).

Although the influence of income in the digital divide has often been thought to be diminishing because of the declining costs of computers, it still is the most fundamental factor affecting material access since the total cost of computers, Internet access and peripherals remains more or less the same. In 2005, van Dijk (2006: 226) estimated that there was a gap in the most developed countries of about 50 % between the highest and the lowest social strata, since a 90 % diffusion rate was found for the first and only a 40 % one for the late. The figure rises until 90 or 95 in a majority of Third World nations.

The international and global digital divide between developed and developing countries seems to remain substantial. After a multivariate regression analysis on 126 countries in 2005, Fuchs (2009) found that GDP per capita was the most important factor influencing the digital divide. Nevertheless, it was not the only significant factor: social inequalities measured by the Gini coefficient, the level of democracy, and the degree of urbanization were also identified as key factors. The results of this study demonstrate that single models of the digital divide, those reducing causes to single variables, are not accurate enough. Complex models considering the interaction of different socioeconomic, political, cultural, social and technological factors are needed.

But even within developing countries, the divide still seems wide and deep—wide because only a small percentage of the total population are Internet users and deep because the consequences of not being an Internet user may be more important in terms of social and career opportunities (Chen and Wellman 2005: 488). Different studies show that in developing countries, the physical access divide is still widening.

This issue becomes even more apparent when we focus on particular social arenas where the digital divide can be noticeable. For instance, at least for some authors, the digital divide in higher education, rather than losing significance, is today gaining more importance (Selwyn 2010). Considering the issues at stake in the field of education and its wider social repercussions, the consequences of this growing gap may be particularly serious. ICT and the Internet allow students to access a large diversity of educational options and to adapt them to their personal situation—time, place and pace of leaning. As Selwyn puts it, after reviewing a number of empirical studies on the digital divide within higher education: "ICT use continues to be a source of subtle but significant social inequality amongst university students in enduring ways" (p. 39).

9.4 From the Single Divide to a Multifaceted and Complex Divide

From the vast amount of academic literature on the digital divide, two main conclusions can be drawn that may be of great interest when exploring other technology-based social gaps, such as the robotics divide. First of all, the digital divide is, on many grounds, still large and important; the almost exponential growth in the social spread of the Internet in the last two decades has not turned it into a negligible phenomenon. Secondly, from a methodological point of view, it is *multifaceted*. There is not a single digital divide: there are instead many different digital divides.

Until very recently, most studies on the digital divide have been almost exclusively concerned with *access* to the technology—basically to computers or to the Internet. On the one hand, surveys were mostly designed to identify and place people in two broad categories: those with access and those without it. On the second hand, the issue of access was mainly tackled as a simple dichotomy and on a static basis—once access was achieved people were thought to remain there for good (van Dijk 2006: 222).

More recent analyses of the divide have instead come to the conclusion that access is not the only important element. The digital divide is no more taken as a simple binary yes/not question of having access to hardware. Recent research has often remarked that the digital divide in present societies refers to much more than access to certain piece of machinery, whereas a desktop or laptop computer—or even than having basic skills and familiarity with common hardware and software

applications. Most of the effective uses of the Internet require not only access to it and some basic computer skills, but also social and cognitive skills. The digital divide is not only a matter of who access the Internet, but of how its use may affect socioeconomic cohesion, inclusion/exclusion, alienation, prosperity or social success.

Usage is in fact the missing term in early approaches to the digital divide. We know now that having access to computers or the Internet is not the same as being able to use them in meaningful or useful ways. As happens with most technologies, one single artefact may be used in a broad spectrum of ways, with a great variety of objectives by different people (Oudshoorn and Pinch 2003). New uses are continuously appearing for old technologies. Not only that, but especially in the field of ICT, we see the emergence of unexpected uses of technology. Some of them are surprisingly different from existing ones, and particularly from those expected, anticipated or recommended by its designers or producers.

9.4.1 Non-Users Matter

This recent shift of attention from plain technology and access, to use and practices of use, has produced a number of important consequences in the conceptualization of the digital divide and the categories associated. One of them is the problematization of non-use and, consequently, of non-users. As happens with many other technologies, non-users have generally been viewed under the assumption that their situation necessarily involves some kind of deprivation or deficiency. In the digital divide arena, those cases in which people with potential access to the Internet voluntarily decide not to be online have hardly been analysed in early studies. We must accept that some people may be not interested at all, while others may feel uneasy when using the Internet—for a number of reasons—or may even express a lack of trust. In fact, a recent survey (Brandtzaeg et al. 2011) shows that 30 % of non-users in five developed countries in Europe do have access to the Internet.

Some taxonomies have been proposed to unveil the complexities of non-use. Wyatt (2003) identifies four different types of non-users. First, what she calls *resistors*—people who have never used the Internet because they never wanted to; second, *rejectors*—those who do not longer use it because they find it uninteresting, boring, risky or expensive; third, the *excluded*—people who have never used the Internet because they could not access it; and fourth, the *expelled*—those who have stopped using it involuntarily because of economic cost or institutional barriers. The widely accepted perspective that universal use has to be the norm for almost every single technology or artefact has prevent many authors from taking non-users as a relevant social actor in explaining uneven social diffusion.

9.4.2 Rethinking Access

In this more recent wave of scholarship on the digital divide, the very concept of access has also been reconceptualized. Though the early studies on the digital divide devoted most of the attention to the technological aspect and then equated technology access with physical access to computers, we do know no, not only that similar levels of access may engage the Internet in radically different ways—equal access does not ensure equal usage-but that different types of access have to be taken into account.

This issue becomes apparent when considering *motivational* access (van Dijk 2006). Before getting physical access to computers and its networks, some kind of wish to be online is needed (even material access itself can be decomposed in physical access to computers and conditional access which refers to different degrees of connection disposal—depending on subscriptions, accounts, broadband, etc.). Being connected is then not only a matter of technological resources availability: as we have already remarked, some people unconnected might have actually refused to be online for different reasons. In addition to those mentioned above, they may see no significant and useful consequence of being online, they may feel they do not have enough time, they may feel computers or the Internet as dangerous, they may think they do not have the necessary skills or operational knowledge, or they may think that the economic cost is too high. Some studies have also identified psychological explanations like technophobia and different kinds of anxiety in front of computers. Some European and American studies between 1999 and 2003 showed that half of the unconnected survey respondents deliberately refused to be connected.

Therefore scholars have increasingly paid attention to more social, psychological and cultural backgrounds surrounding access and use of ICT. The almost exclusive tendency, some years ago, of focussing on the number of people who access or use computers or the Internet and on frequency of use, is no more considered the best way to carry out research on the digital divide. The understanding of access has also moved from a single event of becoming user of a particular technological artefact to a temporal process being influenced by a number of non-technical factors.

Just as material access is preceded by motivational access, it is also succeeded by *skills access* and *usage access* (van Dijk 2006: 224). The increasing analysis of use, beyond access, has brought to the front the issue of skills. Skills can also be decomposed in different types following a certain stage model. Operational skills are needed first when accessing a computer, but then information and strategic skills become crucial for meaningful uses of computers and network resources.

9.4.3 Skills

Skills involved in computer and Internet use are diverse and cannot be reduced to a single set of abilities. A first class of skills encompasses what have been called *instrumental* or *operational* skills. These are the ones needed for operating with hardware and software in a very basic level. Another set of abilities has been named *structural* of *information* skills. Formal information skills involve the knowledge to operate with Internet files, Webs and hyperlinks, whereas informal information skills refer to the ability to find, get, select and assess information in specific Web pages. A final category is that of *strategic* skills: those needed for addressing particular objectives and goals according to the user's expectations, needs and intentions.

Research into information and strategic skills has been much scarcer than that into the traditional digital divide of physical access. And, we must not forget that skills are always a much more difficult issue to research than equipment or technology availability, since users' self-reports of skills, like those provided by surveys, are not often that reliable. Nevertheless, much of the studies and tests that have been carried out show that the skills divide is usually much larger than the physical access divide. They also strikingly prove that, while the access divide is almost closing in most developed nations, the skills gap is growing—particularly when considering information skills (van Dijk 2006; Brandtzæg et al. 2011).

In line with the results of former digital divide studies, the education level shows a strong correlation with the level of skills: users with a high level of traditional literacy do also possess the highest levels of digital information skills. Nevertheless, the concept of *computer literacy* itself has also been called into question by many of these studies on skills. The effective use of ICT and the Internet is no more thought to be based on a relatively simple set of abilities to operate a computer. A *multi-literacies* view tries to emphasize the whole variety of competencies that individuals need to access the digital world and use it in productive and useful way. Carvin (2000) has outlined three basic types of competencies: the *information literacy* that allows users to discern the quality of the content available, the *adaptively literacy* that allows them to develop new skills while using ICTs, and the *occupationally literacy* that allows users to apply these skills in their personal life environment.

Finally, inequality in Internet access and uses does not solely depend on individual skills, capabilities or attitudes. Specific social or institutional contexts may have a crucial role in fostering the access to the Internet. It has been remarked, for instance, that informal training through various ways of social support can provide people the necessary computer and navigation skills to effectively use the Internet.

9.4.4 Usage

Once motivational and material access and skills have been discussed, the final stage, usage, can be treated. We have already pointed out that potential use—availability of computer and Internet resources as well as the skills needed—does not automatically result in actual use. The digital divide tends to appear smaller when actual use is not taken into account. That happens for instance with gender: while the gender gap may look almost inexistent as far as physical access is concerned in many developed countries, when use is considered and deeply analysed, the gap resurfaces again. Generally speaking, once usage comes to the forefront, many traditional social inequalities are translated into the digital divide. So, once more, technology becomes a kind of mirror reflecting—and somehow reinforcing—persisting social differences and inequities (Bijker 2010).

Another aspect of the usage digital divide is the difference between a *consumerist* and passive use and a *productive* or active one. Not all users are equal and similarly creative. This is particularly relevant considering the present spread of Web 2.0 applications and tools, where users are meant to provide most of the content. Though the recent growth in popularity of social networking sites may have partially corrected it, some former studies showed a significant gap between passive and basic uses of the Internet (email, Web browsing, searching) and those more active and creative (contributions to Web sites, blogs, wikis, peer-to-peer networks, etc.) that often involve the collective production and sharing of knowledge and information.

Finally, a certain democratic divide has also been linked to the digital divide when usage is taken into account, since people online have more access to resources in order to engage and participate in public political life. Recent Arab springs, the occupy movement or the Spanish 15 M protests, have highlighted the increasing role of the Internet and social networking in fostering political activism.

This more recent focus on usage has lead many scholars to distinguish and categorize different kinds of Internet users in an approach often called *user typologies*. In a study of Internet users in five European countries (Norway, Sweden, Austria, United Kingdom and Spain), and by means of a cluster analysis on a large and representative sample of 12,666 people, Brandtzæg et al. (2011) identified five types of Internet users.

Non-users are the largest category with 42 % of the sample. People within this cluster do not use the Internet on a regular basis. *Sporadic users* include 18 % of the sample and are formed by people who use the Internet occasionally and infrequently, mainly for e-mail and some other specific tasks. *Entertainment users* group about 10 % of the sample; these are users who show particularly high scores on using Internet radio or TV; downloading games or music; and chatting. *Instrumental users*, about 18 % of the sample, are those who prefer to carry on goal-oriented activities such as searching for information—about goods or services—and use e-commerce, net-banking and travel services. Finally, advanced

users, grouping 12 % of the sample, show the highest scores for almost all Internet variables and thus prove to have a very varied and broad Internet behaviour.

This kind of typologies show not only the different ways in which the Internet may be used, but, most notoriously, the inequalities among users when exploiting the benefits of the net. Considering this study analyses data from five well-developed countries with high GPD, it is surprising that 60 % of the sample is found to be non-users or sporadic users. The figure means that a great majority of citizens do not have enough level of usage for a truly effective digital participation. The authors compare this finding with results from a similar study done five years before and discover only a small decline of 2 % for these two groups. Once more, when usage is taken into account, the digital divide seems a resilient phenomenon indeed.

Though the study reflects the common perception that youngsters are more interested and have more opportunities to learn and explore this new technological media and that access is still an important factor, the existence of contextual variations between countries suggest there must be different cultural variables at play. Gender is also found to be another persistent factor in the digital divide. The fact that in countries known to have more gender equality—like Sweden—gender does not prevent users to become advanced users—something that happen in the other four countries—suggests that previous social differences are also easily transferred to cyberspace.

Finally, the study points to another important aspect of the usage divide. As Internet services and applications evolve, it is very likely that the levels of usage of the different user typologies will increase. Nevertheless, since people who are more active and advanced users will achieve new competencies and skills faster, the divide in terms of the different user categories will most likely grow. New kinds of inequality in the use of the Internet are thus expected in the near future.

9.5 Wrong Assumptions for Tackling the Digital Divide

The maturity reached in the analysis of the digital divide has not only provided more data and insights on new aspects of the divide, but an awareness of the conceptual and methodological flaws of earlier approaches. We have already pointed out some specific ones, and now, we will discuss others with a more basic character.

9.5.1 Internet Access as Multimodal Phenomenon

Access, for example, has been rethought in a number of ways—from a single event, to a process and from a yes/not question, to a gradual attribute. However, the evolution of technology has also put into question another aspect of access.

Although fifteen or ten years ago accessing the Internet was mainly possible through personal computers, nowadays different pieces of equipment and artefacts are available for Internet connection: not only personal computers or laptops, but also mobile and smart phones, tablets, e-books, TV's, game consoles, etc. Any meaningful approach to the digital divide has to acknowledge the present convergence of new media platforms and technologies that allow people to go online.

Computer technology, and particularly Internet access and use, is nowadays a *multi-modal* phenomenon. This is not only a purely technological matter: access and use of the Internet can be greatly affected by the artefact used for establishing the connection. An Internet search through a smartphone is not the same than through a desktop computer. Screen size, software available in the device, speed, cost, size of messages, etc., provide some restrictions and limits for Internet navigation. Depending on the particular artefact being used for connecting to the Internet, there is a wide differing range of technical and social qualities available.

9.5.2 Domestic Divides are also Important

Until very recently, the digital divide was mainly explored following the boundaries of national states. In the last years, many studies have also explored more detailed inequalities within nations. Many authors have argued for a redefinition of the digital divide concept in order to take into account differences between individuals—for instance, the inequalities of Internet use within rather than between nations. The focus has also shifted from developed countries—where the Internet was first diffused—to the developing word.

9.5.3 Taking the Divide Metaphor too Literally

Metaphors are common in many areas of scientific thought. When considering the relationship between technical innovations and social change, some spatial and mechanical metaphors have been traditionally used. We frequently talk of the social *impacts* of a technology—though technology does not come out of the blue, from a non-social medium, and though social impacts of technology do not happen at a single point of time. When taking too literally, metaphors can contribute to confuse the phenomenon at stake. This has often happened in digital divide analyses. The expression "digital divide" may suggest, and indeed, it has frequently suggested, a too dichotomized and sharp distinction between two clearly separated social groups. It has also suggested that the divide is about absolute inequalities between those included and those excluded, whereas most of the inequalities identified by recent studies show a relative and dynamic nature (Brandtzæg et al. 2011).

Empirical research shows that these are oversimplifications of a much more complex reality. The sharp distinction between users and non-users hides significant and more subtle types of relationship to any particular technology. Intermittent users, for instance, are those who become non-users for extended periods of time. In fact, we must not assume that everyone having a piece of machinery is actually using it: possession of the artefact does not equate automatically to use. Many people make a very rare use of computers at home and some do not use them at all. Frequency of use may actually resurface divides that are masked when only access is considered.

9.5.4 Technological Determinism

Technological determinism has been the most implicit theoretical assumption behind many analyses of the digital divide—in fact, technological determinism is still the most influential and popular view of the relationship between technological innovation and social change. It encompasses two different elements: (a) technology develops autonomously following a sort of intrinsic logic and (b) technological development is the most important singular element determining social change (Bijker 2010: 71).

One of the traces of technological determinism can be detected in the almost exclusive emphasis early studies made on access to technology (computers and connection to the Internet, mainly). This has been considered for long the most critical aspect of the divide; this tendency has minimized the other non-physical aspects of the divide that we have already commented. Furthermore, given the multifaceted nature of the digital divide, simple policy measures for narrowing it may be less successful than expected. Since access does not equate with usage, solving the divide is not only a matter of providing computers and Internet connections. The promotion of an effective use of the Internet is certainly more complicated and cannot be reduced to simple policies for fostering access.

Another related technological deterministic idea has been the often implicit consideration that access to computers, *per se*, would trigger important social and economic benefits in a highly mechanistic and causal connection. This scheme underlies a vast majority of the digital divide research. Such an emphasis on the role of technology in overcoming social differences and inequities tends to obscure two recent and empirically based views in the sociology of technology: on the one hand, the fact that technical artefacts are usually shaped by particular values and visions—sometimes well rooted in the status quo, and, on the other hand, the fact that new technologies may also contribute to reinforcing and consolidating existing social differences (Aibar 2010).

9.5.5 The Linear Model of Technological Development

Many digital divide studies have also shared an understanding of ICTs evolution and diffusion as a *linear* process where these technologies increasingly spread through the whole society. Sometimes, digital divide researchers have even resorted to diffusion of innovation theory and its most fashionable version, the S-curve—an incredibly popular perspective in business and marketing literature—as a simple model for the social adoption and acceptance of ICT. Under this deterministic view, technology diffusion is implicitly assumed to follow an autonomous path of necessary and mechanistically joined steps, so further research into social shaping forces or actors is not considered necessary or very relevant.

The social actors or social aspects involved are instead considered sometimes only as *obstacles* to the autonomous and unidirectional path of technological innovation, which seems to be powered by an internal *momentum*. Therefore, some authors talk about the cultural or social "barriers" to ICT or the Internet, for instance, and others resort very easily to different kinds of social or human "resistances" against technological innovations.

9.5.6 Methodological Flaws

Van Dijk (2006) points to several theoretical and methodological flaws of digital divide research and analysis. First of all is lack of theory. Much of the research has got a very descriptive nature and the analysis of deeper social, cultural or psychological causes influencing the divide has been very much neglected. The lack of qualitative research has somehow obscured the actual mechanisms in the process of appropriation and domestication of ICT-related technologies. And, most quantitative studies, though presenting a great deal of correlations, have not included longitudinal data, particularly necessary in such a changing technological landscape.

Another problem is the lack of interdisciplinary research. The preponderance of sociological and economic research has underestimated psychological, educational and cultural factors affecting the digital divide and, more specifically, the usage dimension.

9.6 Conclusions: Lessons for Analysing the Robotics Divide

The lessons we can learn from the last 15 years of digital divide research and analyses are particularly relevant for present and future efforts to address the robotics divide. Not only because robotics and ICT are two areas of technology deeply interconnected for obvious technical reasons, but because the social

diffusion of robots is increasingly foreseen in the light of what we know about the diffusion of ICT and the Internet. Bill Gates has been quoted to observe that "the emergence of the robotics industry […] is developing in much the same way that the computer business did 30 years ago" (quoted in Lin et al. 2011: 942).

It is very likely that many experts agree with such a perspective—considering it comes from one of the key figures in the computer business. But what is more worrying is that many of these experts seem to be falling again in some of the typical mistakes that we observed in the analysis of the digital divide. Not only exponential progress, following dubious laws of technological development such as Moore's law, is forecasted but ubiquitous diffusion of robots throughout society is also expected.

Most of the flaws in digital divide research we have identified in this chapter rest on very well-known views of the relationship between technology and society, that is, between technological innovation and social change. Some of these old views, I have argued, are based on assumptions that are not necessarily consistent with what we already knew about technology and society and the many ways they interact.

Science and technology studies (STS) have been critically analysing the interaction between science, technology and society for the last four decades and have developed a deep and very rich picture of its intricacies (Hackett et al. 2008). I have used their approach in order to identify some of these persistent misconceptions and, thus, show some opportunities for improving future research in the robotics divide.

A first general lesson we may draw from STS is that technological innovation is not a single point-in-time event but a process occurring over time and subject to many heterogeneous forces. Technologies are not "ready made" at one point after their design and development phase, and then spread throughout society. Implementation and use often produce changes in design (Bijker 2010).

In the last decade, there has been an increasing amount of scholarship devoted to the understanding of user–technology relations—this has represented a remarkable shift from the older and more usual study of designers by most social analysts of technology (Oudshoorn and Pinch 2003). This change in orientation has also occurred in the social study of ICT. But although there are many studies of users and uses of ICT in very different areas, there are still some insights into this broader literature on users and technological artefacts that could be particularly useful for tacking other technological divides.

First of all, users should be understood as active and not passive participants in the evolution of technology. They are not simple consumers, but active agents in the *domestication* and adaptation of artefacts to their own objectives and interests. We should not forget that the very origin and evolution of the Internet shows this remarkable blurring of the distinction between users and producers (Abbate 1999).

Secondly, social scientists should place more emphasis on the disaggregation needed to understand the many possible uses of any technology. Another important lesson from STS in this area is that there is never a "correct" use of a technology: there are only intended, recommended, expected or dominant uses. Use is never

deduced from the technology itself and though designers or producers invest a lot of time and resources to discipline their future users, it is always possible that they end up with totally new and surprising uses.

Another important lesson to be learned from STS concerns the alleged revolutionary power that we tend to confer to technology—whether ICT or robotics. The way we academics tend to phrase our research questions is often too grandiloquent—it seems that we have been infected by the same virus that affects enthusiastic journalism, supply-side marketing and oversimplified policy visions, maybe because academic social science is often in dialogue with them. Whenever we envisage changes (linked to technology), it seems they have to be big, revolutionary and dramatic. And this kind of research megalomania affects not only the deepness of those changes but their scope. Things are expected to change a lot and worldwide.

A useful recommendation to avoid this kind of pitfall should be again *disaggregation*. I think we need to disaggregate society, users and even technologies much more, otherwise our conclusions lose relevance and soundness. Whenever we talk about important changes or impacts, we have to specify how important they are, in what particular circumstances and for whom—this applies to both ICT and robotics (López-Peláez and Kyryakou 2008).

In that context, the *performative* character of technology narratives should also not be forgotten. Not only does technology have social effects, but so also do discourses about them. In the field of e-Government, for instance, the aggressive and deterministic views and stories produced by consulting, software and hardware companies have had a very deep influence in the way ICT and the Internet have been used in the last decade by many governments (Waksberg and Aibar 2007).

Another remarkable consequence of the deterministic "impacts" frame is the treatment of technology social effects as universal, predictable and unidirectional. In most cases, this is inaccurate. A large proportion of STS empirically based case studies have been, in fact, devoted to demonstrating that the uses and effects of technologies depend decisively on local social contexts. ICTs alleged effects cannot be seen as independent of the social environment where they have actually been designed and created. We need more informed studies not only on technology effects on society, but on the way, technologies themselves are actually designed, developed, tested and thus shaped along those processes. We need also to bear in mind that innovation is not only a scalar magnitude but a vector, that is, something that has got another property worth of mention: direction.

Finally, maybe, the most important contribution of STS has been to prove that the link between technology and society is always twofold. Technology impacts society but society, in its turn, shapes technology. That simple thesis has got important implications when analysing technological divides and their relationship with social inequalities.

It is not only that different social inequalities greatly explain technological divides, but that those technological divides, themselves, may have a deep impact in the continuation or even the deepening of those social inequalities. Though ICTs have often been considered a potential source for change in many social arenas, it

has also been proved that they can reinforce existing organizational structures or power relations in other contexts.

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