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Author(s): Fortunati, Leopoldina; Taipale, Sakari; Luca, Federico de

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Digital generations, but not as we know them

Abstract

The aim of the article is to see whether or not adolescents were the real leaders of the digital 'revolution' in the 1990s and whether they have sustained or even improved their position in the 2000s. The analysis is based on two surveys carried out in Italy, France, the United Kingdom, Germany and Spain in 1996 (N=6,609) and in 2009 (N=7,255). The results show that the adolescents belonging to the first digital generation in 1996 were the most equipped with new technologies, although not the most intensive users. In 2009, the adolescents lost their position as the leading adopters and lagged behind youth and young adults regarding the use of new technologies and computer skills.

Keywords: adolescents, youth, young adults, digital generations, digital native generations, digital technologies, digital technology diffusion, digital technology use, EU5

Digital generations, but not as we know them

Introduction

The shared belief that adolescents especially and youth are the most digital technology-equipped as well as the most innovative and competent users developed in the 1990s, particularly in the field of information and communication technology (ICT) use studies. This belief has remained almost an unquestioned truth until the present day in scientific literature that has repeatedly paid attention to young people (c.f. Hargittai and Hinnant, 2008). In almost all these studies, age has proved to be one of the most important variables. At the same time, only a few attempts have been made to compare youth with other age groups (e.g. Gomez and Camacho, 2013). Nearly two decades after the commercialization of mobile phones and the Internet, the time is ripe to dissect the category of youth. The overall aim of this article is to see whether or not adolescents were the real leaders of the digital 'revolution' in the second half of the 1990s and whether they have sustained or even improved their position towards the end of the first decade of the new millennium.

More specifically, the paper investigates adolescents (14–17 year-olds) and youth (18–24 year-olds) (young people is used hereafter to designate these two age groups) who

represent a variety of so-called different digital generations (generation x, generation y, millennials, etc.), in two points of time, 1996 and 2009. We compare adolescents with youth and young adults (25–44 year-olds) as well as with adults (45–64 year-olds) and the elderly (65 year-olds and older) in order to find out if the differences between these age groups regarding the adoption and use of new media have remained the same or changed over time. The focus will be on two main digital technologies, the mobile phone and the Internet, although we will contrast the related data with those regarding the fixed telephone and the computer. In this research project, we used the data collected from five European countries: Italy, France, Germany, Spain, and the UK (EU5).[1]

This study was designed to fill some gaps in the current research on adolescents and youth and digital technologies. Previous studies have typically been based on qualitative research designs (c.f. Pertierra et al., 2002; Law, 2012) or country specific data sets (Helsper and Eynon, 2010; Helsper, 2010; Hargittai, 2002). Moreover, being situated themselves in the field of communication studies (Ling, 2004; Katz and Aakhus, 2002), previous results have not been fully elaborated in the light of the most crucial sociological categories. The present study is quantitative, based on international repeated cross-sectional surveys that enable comparisons of the adoption and use of digital technologies between the described age groups across time.

The design of this study aims also to reflect on the question of digital generations and to further elaborate the relationship between the notion of age group, cohort and the various conceptualizations of generation. We adopted an age group based approach because we deemed that only this approach could provide evidence on how adolescents as owners and users have changed their engagement with these new technologies over time. Instead, a cohort-based approach would have allowed extrapolation that, for example, the adolescents of 1996 were the young adults in 2009 (being in that year 27–30 year-olds).

Young people who were born in the late 1970s and at the beginning of 1980, when the first big introduction of information systems in workplaces took place in Europe, are considered as the *first digital generation.* While growing up, they encountered and experienced the first digital technologies. Compared with the older age groups, the adolescents involved in the 2009 survey were in a particular life phase, in which individuals easily relate to new technologies and are receptive to innovation (Moscovici, 1976; Fortunati, 2009). This generation re-invented the mobile phone as a technological artefact, for example, by launching SMS as a communicative practice (Taylor and Vincent, 2005) and by pressing operators to include music services (Glotz at al., 2005). With *the second digital generation,* we mean those who were born in

Europe in the second half of the 1980s and the 1990s, when digital technologies began their mass diffusion. Being born when these technologies were already spread throughout everyday life makes a difference in contrast to encountering them at a later point of life. While for the second digital generation, media environments form a social context of action that embraces a large part of adolescents' everyday life (Comunello et al., 2016), for the first digital generation there was much enthusiasm surrounding their discovery.

The article is structured in the following way. The next section deals with the intricate sociological notion of generation (e.g. Manheim, 1952) and analyses how this notion is connected to the demographic concepts of cohort and age group, and their ongoing significant modifications. The following section is dedicated to introducing the particular conditions of life in which adolescents and youth are both currently immersed. The methods that are applied in the study and that fit into the field of quantitative studies are then described. The results will be presented before addressing the main findings in the final discussion.

Theoretical framework

Generation as an intricate matter

Societies construct historically determined conceptualizations of adolescents, youth and other age groups (Tapscott, 1998, 2008). To a certain degree, these social constructs are consistent with the empirical evidence and common knowledge. However, they also convey inaccuracies, including the perceptions of adolescents and youth through the eyes of adults, as well as stereotypes, myths and urban legends. The same phenomenon occurs in terms of gender (Butler, 1990; Bornstein, 1994). Apart from this, the living experiences of age and generations are highly mutable. Just as we are constantly in the process of *becoming* a gender, rather than *being* a gender, we are also in the process of becoming a child, adolescent, youth, adult and elderly rather than being part of a particular age group (Fortunati, 2009).

The second element that adds to the complexity of the concept of age-group is the way they are operationalized. Recently demographers have proposed an adjustment to the number of age groups following the changed consistency of the classical age groups and the increase in life expectancy (Tebano, 2013). The amendments to the total number of age groups have been made to acknowledge the socio-demographic changes occurring at the level of age stratification (Lutz et al., 2008). For instance, in aging societies, the elderly represent an ever-growing part of the population with the consequence that the relative importance of other age groups decreases.

Age has often been approached through the demographic concept of cohort, even in sociology. However, there is a need to understand what type of age group one is talking about, in terms of its distinctive social, cultural, and political identity. This brings us to the notion of generation, which refers to an age cohort that comes to have social significance by virtue of constituting itself within a social, cultural and political identity (e.g. Edmunds and Turner, 2002; Mannheim, 1952). Thus, this study reflects on the notion of generation to better understand the relationships between adolescents, youth and digital technologies.

The rise of digital technologies brought about a new discourse on generations. In this discourse, the youngest generations were often considered as innately technology-savvy (e.g. Prensky, 2001a, 2001b) and schools were depicted playing a crucial role in ensuring equal opportunity for all children and teenagers to access the benefits of computer technology (e.g. Holmes, 1999; Becker, 2000; Selwyn and Bullon, 2000). Prensky introduced a distinction between ‘digital natives’ and ‘digital immigrants’ to describe the differences between those who were born with digital technologies and those who encountered them only at a later age. On the credit side, Prensky’s approach is insightful. It was one of the first attempts to conjoin the concept of generation and digital technologies in the context of education. Like all brave conceptual openings,

Prensky's notions have been criticized. Critics have stressed that the mere possession and availability of the newest digital technologies does not automatically mean that the 'digital natives' independently master the latest technological innovations (e.g. Bennet et al., 2008; Hargittai, 2010; Jones et al., 2010; Herold, 2012).

Bearing in mind these shortcomings, but also the strength of the concept of generation, this study aims to revisit the notion of digital generations. Now let us sketch the paradox in which adolescents and youth (and often young adults) are immersed.

In-between empowerment and disempowerment

Adolescents and youth, what we call here young people, are currently in an ambivalent and even paradoxical situation in industrialized countries, as they face processes of both empowerment and disempowerment. We argue that these wider social processes affect young people's behaviour over time regarding the adoption and use of digital technologies. While the processes of empowerment and disempowerment are here examined in the context of family, education system, and labour market, the developments in the adoption and use of digital technologies are viewed as young people's reactions to these social processes.

First, it is sure that on the one hand young people have increased their power inside the family (Fortunati, 2014). In the last decades, there has been a discussion about how parents have applied a more permissive parenthood, which has intensified a – sometimes friend-like – relationship with children (Churchill and Clarke, 2010). Moreover, young people have increased their relative power inside the family because the average number of children has declined in the family (Giusti and Mannuncci, 2000). Especially in one child families, increasingly more attention and care are directed towards the sole child. Against this backdrop, young people have been able, through continuous negotiations with their parents, to strengthen their identities and impose their tastes and desires.

On the other hand, young people have been disempowered by their greater isolation inside and outside the home. Inside the home, they experience the lack of having fewer or no siblings. This is a severe lack, as peer relationships are vital for them. Peer relationships help young people in socializing and cultivating affective relationships because these have more equal distribution of power than the relationships between parents and children. Outside the home, the power of young people has been attenuated, for example, by the limited possibilities of moving even in a nearby territory that parents perceive more insidious and complex than in the past. Having lost some freedom in moving alone in an urban environment has also implied more control by

parents over young people (Fortunati and Taipale, 2013). In addition, young people who grew up during the deep recession of the 1990s had parents who were pushed to become career-oriented paid workers and who could dedicate less time to them (Lewis, 2007).

The same process of empowerment and disempowerment concerns young people in the education system. The number of years spent by young people in education has lengthened (Santoro, 2004), which has contributed to their empowerment. Nevertheless, this does not represent an empowerment process only, because the educational system in total has faced mounting difficulties in guaranteeing an acceptable quality of education and informational offering in several European countries (OECD, 2013; Bérubé and Nelson, 1995).

In the labour market, the negative trends outnumber the positive ones. In the last two decades, young people have been facing a hostile and precarious labour market that has poorly absorbed young workers. Of the studied countries, youth unemployment has been highest in Spain (37.8% in 2009, and 50.7% in 2012), Italy (25.4%, 34.2%) and France (24.0%, 23.1%), while in the UK (19.1%, 22.0%) and Germany (11.2%, 8.1%) the situation has been somewhat better (EuroStat, 2013). Consequently, young people have experienced severe income problems and often postponed leaving the parental home (c.f. Holdsworth, 2000). However, country differences in the age of leaving the

parental home are noteworthy, as the public support of young people's autonomy and welfare varies considerably in Europe. Among the EU5 countries, for the generation born around 1960, the average age of leaving home was highest in Italy and Spain, followed by the UK and Germany, while in France, young adults left the parental home at the youngest age (Billari et al., 2001; Holdsworth, 2000). In Southern Europe, employment and income have proved to be strong predictors for leaving home; in the UK, for instance, the majority of young adults leave their parental home regardless of their income and employment (Aassve et al., 2002: 272–273). Overall, the economic dependence on parents seems to result in the 'infantilization' of young generations.

To sum up, today young people encounter a paradoxical situation, as they have both acquired and lost power. Given this turbulent situation, the present study will show how young people were associated with the adoption and use of digital technologies in 1996, and more recently in 2009. The study provides much needed generalizable and longitudinal data on young people's relationship with digital technologies.

Based on the above arguments, the following three research questions were defined for the study. As the first research question (RQ1), we ask whether adolescents were really the most equipped and active user generation in 1996. As the literature reviewed indicates, writers like Prensky would suggest that adolescents were the most equipped

with new technologies and used various digital technologies more than the other age groups. As a second research question (RQ2), we ask if the adolescents' position remained unchanged in terms of the adoption and use of digital technologies between 1996 and 2009. Based on the trends and discourse on dis/empowerment above, we have reason to believe that they have not managed to sustain their position. If the first digital generation in 1996 was at the cutting edge due to their emerging interest towards new technologies, the adoption and use of the second digital generation might be more influenced by the described social processes of empowerment/disempowerment. The third research question (RQ3) asks whether or not adolescents were at the cutting edge in terms of computer skills in 1996, and if they sustained their relative position between 1996 and 2009. Writers such as Tapscott and Prensky would lead us to expect that adolescents in the 1990s considered themselves more skilful than other age groups at that time. However, we believe that adolescents' computer skills, as evaluated by themselves in this study, did not increase between 1996 and 2009. While being generally more receptive to new innovation and technologies than older age groups (Moscovici, 1976), we assume that adolescents in 2009 evaluated their computer skill lower that youth and young adults, who have used basic computer technologies much longer and for multiple purposes, ranging from work and family to leisure and social relation management. However, the second digital generation might have developed other type of skills, such as social networking and online communication skills, that

resonate with recent technological developments (e.g. the introduction of social media) and that assist them in counterbalancing the effects of the increased social isolation in the family. However, our data unfortunately does not provide measurements to verify this.

Method

Respondent profiles in the two surveys

This study is based on repeated cross-national surveys in the five most populous and industrialized European countries (called also EU5).[2] The data was collected as a telephone survey in Italy, France, the United Kingdom, Germany and Spain in 1996 (N=6,609) and 2009 (N=7,255). Both studies, not based on the same sample, were carried out by at least one of the authors and were funded by Telecom Italia. A large number of measures on the adoption and use of a wide range of digital technologies were used in both surveys, while previous research had typically dealt with the use of single technologies. The questionnaire was basically the same in both surveys, although the 2009 study was adapted to the new technological situation. Questionnaires were pre-tested both in 1996 and in 2009 with 100 people in order to verify the appropriateness of the questions and duration of the telephone interviews. In the analysis, we use

weighted data to correct some distortions relating to age, education, ownership of a computer and access to the Internet. The respondent profiles of the data sets are presented in Table 1.

	1996	2009
Variable	Frequency and %	Frequency and %
Nation		
Italy	1376 (20.8)	1399 (19.3)
France	1334 (20.2)	1424 (19.6)
Germany	1767 (26.7)	1919 (26.5)
UK	1183 (17.9)	1411 (19.5)
Spain	948 (14.3)	1103 (15.2)
Total N	6609 (100.00)	7255 (100.0)
Gender		
Males	3170 (48.0)	3551 (48.9)
Females	3439 (52.0)	3704 (51.1)
Total N	6609 (100.0)	7255 (100.0)
Age		
14-17 years (adolescents)	417 (6.3)	332 (4.6)
18-24 years (youth)	751 (11.4)	787 (10.8)

25-44 years (young adults)	2341 (35.4)	2375 (32.7)
45-64 years (adults)	1875 (28.4)	2215 (30.5)
65 years and more (elderly)	1200 (18.2)	1547 (21.3)
No answer	25 (0.4)	
Total N	6609 (100.0)	7255 (100.0)
Education		
Low	2584 (39.1)	2083 (28.7)
Medium	2365 (35.8)	3214 (44.3)
High	1290 (19.5)	1798 (24.8)
No answer	31 (0.5)	159 (2.2)
Total N	6609 (100.00)	7255 (100.0)
Activity		
Worker	3089 (46.7)	3823 (52.7)
Houseperson	586 (8.9)	593 (8.2)
Unemployed	444 (6.7)	283 (3.9)
Retired	1449 (21.9)	1952 (26.9)
Student	813 (12.3)	547 (7.5)
No answer	229 (3.5)	57 (0.8)
Total N	6609 (100.0)	7255 (100.0)
Degree of urbanization		

Relative rural	2270	(34.3)	2387	(32.9)
Essentially urban	1848	(28.0)	2876	(39.6)
Essentially rural	1174	(17.8)	657	(9.1)
No answer	1318	(19.9)	1335	(18.4)
Total N	6609	100.0	7255	(100.0)

Table 1 Distribution of the participants in 1996 and 2009 on the base of the socio-demographic variables considered

Measures

Possession. In 1996, regarding the possession of the *mobile phone*, which at that time was a portable tool for the household and not yet a personal device, the question was formulated: 'Has your household at least one mobile phone?' The possession of a *computer* and *Internet access* were measured with the following question: 'Which of the following types of equipment or services do you have in your home?' To all these questions, the answering choices 'Yes' and 'No' were provided.[2] In 1996, the possession of the mobile phone, the computer and Internet access were 15.3%, 33.2% and 2.7%, respectively.

In 2009, since the *mobile phone* had become a more personal communication tool, the question for its possession was: ‘Which of the following types of equipment do you own personally?’ The possession of a *computer* and *Internet access* were measured with the same question as in the previous survey: ‘Which of the following types of equipment or services do you have in your home?’ To all these questions, the answering choices ‘Yes’ and ‘No’ were provided. In 2009, the possession of the mobile phone, the computer and Internet access were 82.6%, 69.7% and 61.3% respectively.

Use. In 1996, the use of a *mobile phone* was measured with two questions: ‘On average, how many calls per day (or per week, if you prefer) do you manage by your mobile?’ and ‘Approximately how many calls do you personally receive on your mobile per day/per week?’ The answers to these two questions were combined, and numbers that were supplied as calls per week were transformed to calls per day. As to *fixed telephone use*, the formulation of the questions was the same as for mobile usage. *Computer use* was investigated with the question: ‘How often do you use it at home?’ with the following items of answer: every day, several times a week, once a week, mostly at weekends, several times a month, once a month, less often, no answer/refused. Finally,

Internet use and SMS use were not measured in 1996 as they were not yet commonly available.

In 2009, the use of a *mobile phone* was measured with four questions: ‘On average, how many calls per day (or per week, if you prefer) do you make on your mobile?’ and ‘Approximately how many calls do you personally receive on your mobile per day/per week?’ The answers to the first two questions were combined, and numbers that were supplied as calls per week were transformed to total calls per day. The other two questions concerned Short Message Service (SMS) *use*: ‘On average, how many SMS do you send per day (or per week, if you prefer) on your mobile?’ and approximately how many SMS do you receive on your mobile per day/per week?’ The answers to these two questions were transformed to total SMS texts per day. Two further questions concerned the *fixed telephone use*, and the formulation of the related questions was exactly the same as for mobile usage. These questions on fixed telephone use were included in the analysis to understand better the practices of use of the mobile phone. *Computer use* was investigated with a simplified question compared with the previous survey: ‘Do you personally use this computer when you are at home?’ This question had only two possible answers: ‘Yes, at least sometimes’ and ‘No, never’ (83.6% vs. 16.4%). *Internet use* was measured by asking ‘How often, and how much, do you personally use the Internet from home?’ with the following possible answers:

every/nearly every day, four hours or more; every/nearly every day – three hours or more; every/nearly every day – two hours or more; every/nearly every day – one hour or more; every/nearly every day – less than an hour; several times per week; mainly at weekends only; occasionally (irregularly); rarely.

Competence. In 1996, self-perception of competence with computer use skills was investigated with the question: 'How would you describe your computer skills?' The possible answers were: I've used one but I don't really know how to; I can get by, using a computer; I'm quite good in using a computer; and I consider myself to be an expert in using a computer.

In the 2009 survey, self-perception of competence with computer use skills was investigated with the question: 'Which of these statements best describes your computer skills?' with the same answer options as in the previous survey.

Data analysis

The analysis reported here is based on descriptive statistics, chi-square tests and standardized residuals, t-tests with the Holm-Bonferroni adjustment, and Kruskal-

Wallis tests. We approached the possession of digital media by means of cross-tabulations between the ownership of the single device and the age, to which we applied the chi-square test. When the relationship between the two variables was significant, we looked at the standardized residuals (st.res.), which are statistically significant when the absolute value is higher than 2.0. We also examined the use of the digital devices by means of t-tests with the Holm-Bonferroni adjustment. Finally, we analyzed self-perception of competence with computer skills through t-tests and the Kruskal-Wallis test to verify the significance of the variation in the considered period of time. The main methodological limitation is that more sophisticated analyses on the use of the considered technologies were not possible due to the heavily skewed distribution of the data. Several transformations were applied to the data but all were ineffective for obtaining a normally shaped distribution.

Results

In this section, we provide answers to our research questions. To this end, we produced four tables concerning age group differences. In Table 2 we compared the possession of mobile phone, personal computer and access to the Internet in 1996 and 2009. Possession of a landline telephone was not included in the analysis (nor in Table 2) as it was a prerequisite to participate in the telephone survey study. In Table 3, we illustrate

daily averages of mobile calls and SMS texts, and we contrast them with the use of the landline phone. Table 4 presents computer and Internet use in the same period of time. Finally, in Table 5 we report the results concerning self-evaluation of competence with personal computer skills in 2009 and 1996.

Possession and use of mobile phone and computer, and Internet access

In response to the first research question (RQ1), whether adolescents were the most equipped and active user generation in 1996, Table 2 shows us that adolescents in 1996 were at the cutting edge regarding the possession of mobile phones and personal computers. Only in terms of access to the Internet were adolescents overtaken by youth (18–24) and young adults (25–44). In contrast, from Table 3 we can see that adolescents in 1996 were not different from any other group when it comes to the volume of mobile phone calls. For the sake of comparison, it is interesting to note that adolescents do not differ regarding use of the fixed phone from other age groups, with the exception of the elderly, who used it less than the others in 1996. Again, regarding use of a computer, the adolescents were not using it more than the youth and young adults, but they used it significantly more than the adults and the elderly in 1996.

To provide answers to the second research question (RQ2), whether the adolescents' position remained unchanged in terms of the adoption and use of digital technologies between 1996 and 2009, we provide answers in two parts. First, we present the results concerning the adoption of digital technologies by referring to Table 2. This table shows that adolescents were no longer showing the highest rate of possession of a mobile. Their mobile possession increased less than that of youth and young adults, who overtook them in this respect. We also add that adolescents increased their mobile phone possession rate almost to the same degree as adults (66.9 % and 66.3%, respectively). It also worth noting that the elderly, whose rate of mobile phone adoption was extremely low in 1996, showed incredible improvement (from 5.6% to 62.9%) in these 13 years (1996–2009). Even regarding the personal computer, adolescents lost their first place in terms of adoption as the youth took over. While youth and young adults (+46.5% and +43.5%, respectively) were able to almost double the percentage of their possession, adolescents reached a rate of adoption even smaller than that of adults (+37.9% and +38.1%, respectively**).** Finally, as regards Internet access, adolescents were able to overtake young adults, but not to catch up the youth, who ranked first in this respect also in 2009. It is worth noting that the elderly also demonstrated a consistent increase in the possession of all three technologies, although they remained behind all the other age groups in using the computer and accessing the Internet.

Some interesting remarks on the variation of adoption rates between 1996 and 2009 can also be presented here. Table 2 reveals that it was youth and young adults who most increased the rate of mobile phone possession between 1996 and 2009 (+75.2% and +73.7%, respectively). Meanwhile, adolescents presented almost the same increase in adoption rate as adults (+66.9% and +66.3%, respectively). As to the personal computer, we find the same patterns in the rates of adoption. While youth and young adults (+46.5% and +43.5%, respectively) were able to almost double the percentage of possession, adolescents reached a much lower adoption rate, staying slightly behind the rate of adults (+37.9% and +38.1%, respectively). In addition, it was youth who ranked first in respect to the increase in Internet access between 1996 and 2009 (+75.9%). The youth were closely followed by adolescents (+71.3%) and young adults (+70.3%).

Regarding the second part of the RQ2, dealing with the use of digital technologies between 1996 and 2009, we refer to Tables 3 and 4. As our response to research question 1 showed, in 1996 adolescents were not at the cutting edge of the use of any of the technologies considered. However, Tables 3 and 4 indicate a slight improvement in the adolescents' position between 1996 and 2009, yet only in respect to use of the mobile phone. In 2009, adolescents differed only from the elderly in terms of making and receiving more mobile calls. Regarding SMS texts, which were measured only in 2009, it turned out that adolescents used them to the same extent as youth, which

exceeded the usage rate of all other age groups. For the sake of comparison, it is interesting to see that adolescents used the fixed phone to the same extent as all other age groups except the elderly, who used it less than others. In 2009, in respect to the time spent on the computer, adolescents surpassed only the adults. Finally, adolescents devoted more time to use of the Internet, together with youth, than the other age groups.

Some interesting remarks on the variation in the use of digital technologies between 1996 and 2009 which contribute to answering the second part of this research question are presented here. Tables 3 and 4 tell us that for the overall sample there was a significant increase in the average number of mobile (+1.36) and fixed telephone calls (+0.97) and the average daily hours spent on the computer (+0.04). The increase in mobile phone calls and computer use particularly involved youth (+3.74 and +0.12, respectively) and young adults (+1.72 and +0.08, respectively), while the use of the fixed telephone increased in all age groups consistently. This finding on the increase in use of the fixed telephone partially debunks the myth that the mobile phone has cannibalized the use of the landline telephone.

	14–17	18–24	25–44	45–64	65+	Overall proportion	**Significance (χ^2)**
1996 Mobile phone	22.6*	20.4*	18.4*	14.1	5.6	15.3	p<.001
2009 Mobile phone	89.5	95.6*	92.1*	80.4	62.9	82.6	p<.001
1996–2009 variation	*+66.9*	*+75.2*	*+73.7*	*+66.3*	*+57.3*	*+67.3*	
Significance (t-test)	p<.001	p<.001	p<.001	p<.001	p<.001	p<.001	
1996 Personal computer	48.3*	43.5*	39.5*	32.6	10.2	33.2	p<.001
2009 Personal computer	86.2*	90.0*	83.0*	70.7	33.8	69.7	p<.001
1996–2009 variation	*+37.9*	*+46.5*	*+ 43.5*	*+38.1*	*+23.6*	*+36.5*	
Significance (t-test)	p<.001	p<.001	p<.001	p<.001	p<.001	p<.001	
1996 Internet	3.2*	4.0*	3.6*	2.1	0.8	2.7	p<.001
2009 Internet	74.5*	79.9*	73.9*	62.0	28.6	61.3	p<.001
1996–2009 variation	*+71.3*	*+75.9*	*+70.3*	*+59.9*	*+27.8*	*+58.6*	
Significance (t-test)	p<.001	p<.001	p<.001	p<.001	p<.001	p<.001	

Note: The asterisk shows the cell where the standardized residual was significant.

Table 2. Possession of the digital technologies in EU5 in 1996 and 2009 (%)

1996								**2009**								**1996–2009**	
Mobile phone use								**Mobile phone use**								**Variation**	
					N	**Average number of daily calls**	**SD**						**N**	**Average number of daily calls**	**SD**	**On average**	**p**
	18-24	25-44	45-64	65 +					18-24	25-44	45-64	65+					
14–17	0.958	0.511	0.612	0.093	34	6.12	8.42	14-17	0.205	0.737	0.067	**0.000**	300	8.77	8.45	2.65	0.084
18–24		0.278	0.438	0.139	92	6.02	9.68	18-24		0.107	**0.000**	**0.000**	698	9.76	12.26	3.74	**0.005**
25–44			0.550	**0.039**	366	7.26	9.85	25-44			**0.000**	**0.000**	2278	8.98	10.71	1.72	**0.004**
45–64				**0.010**	197	6.79	6.91	45-64				**0.000**	1773	7.63	10.19	0.83	0.261
65+					23	3.06	3.29	65+					321	5.03	5.98	1.98	0.121
Total					712	6.71	8.82	Total					5370	8.06	10.19	1.36	**0.001**
								SMS									
													N	**Daily average of daily SMS**	**SD**		
									18-24	25-44	45-64	65+					
								14-17	0.155	**0.000**	**0.000**	**0.000**	232	14.45	17.68		
								18-24		**0.000**	**0.000**	**0.000**	550	17.42	29.21		

Note. In the table, all values in bold are statistically significant at the level of <0.05.

Table 3. Daily calls on the fixed and mobile phone as well as SMS: The comparison between age groups averages in 1996 and 2009 as well as their variation over time (t-test with the Holm-Bonferroni adjustment)

1996								**2009**								**1996-2009**	
Computer use								**Computer use**								**Variation**	
					N	**Average proportion of users**	**SD**						**N**	**Average proportion of users**	**SD**	**In the proportion**	**p**
	18-24	25-44	45-64	65 +					18-24	25-44	45-64	65 +					
14–17	1.000	1.000	**0.000**	**0.003**	147	0.88	0.33	14-17	0.364	1.000	**0.000**	0.661	317	0.88	0.33	0.00	1.000
18–24		1.000	**0.002**	0.099	305	0.81	0.40	18-24		**0.000**	**0.000**	**0.002**	714	0.93	0.26	**0.12**	**0.001**
25–44			**0.000**	**0.005**	920	0.84	0.36	25-44			**0.000**	1.000	2266	0.85	0.36	0.01	1.000
45–64				1.000	457	0.70	0.46	45-64				1.000	1697	0.78	0.42	**0.08**	**0.001**
65+					62	0.66	0.48	65+					183	0.81	0.39	0.15	0.149
Total					1891	0.80	0.40	Total					5177	0.84	0.37	**0.04**	**0.001**
								Internet use									
													N	**Average daily number of hours**	**SD**		
									18-24	25-44	45-64	65+					
								14-17	.579	**.004**	**.000**	**.001**	249	**2.05**	1.02		
								18-24		**.001**	**.000**	**.000**	587	**2.10**	1.11		

Note. In the table, all values in bold are statistically significant at the level of <0.05.

Table 4. Computer and Internet use: The comparison between age groups averages in 1996 and 2009 as well as their variation over time (t-test with the Holm-Bonferroni adjustment)

Self-evaluation of computer skills

In respect to RQ3, whether or not adolescents were at the cutting edge in terms of computer skills in 1996, and if they had sustained their relative position between 1996 and 2009, we report the results of our investigation in Table 5. In line with our previous expectations, this time too we do not find an overall increase in computer skills among adolescents.

1996	14–17	18–24	25–44	45–64	65+	tot.	Sig.
Don’t know how to use it	12.3	6.3	7.5	8.9	**13.4**	8.4	0.002
I can get by	37.3	33.7	34.6	40.3	42.8	36.3	
Quite good	47.3	49.6	44.2	39.8	28.6	43.9	
Expert at using computer	3.2	10.4	13.8	11.0	12.2	11.4	
Total	100.0	100.0	100.0	100.0	100.0	100.0	
2009	**14–17**	**18–24**	**25–44**	**45–64**	**65+**	**tot.**	**Sig.**

Don’t know how to use it	6.8	6.2	8.3	8.3	11.2	8.1	0.001
I can get by	34.2	30.6	39.9	**45.6**	**60.2**	41.8	
Quite good	**52.1**	**52.2**	41.5	37.4	28.0	41.3	
Expert at using computer	6.9	**11.1**	**10.3**	8.8	0.7	8.8	
Total	100.0	100.0	100.0	100.0	100.0	100.0	

Note. Values in bold indicate the standardized residuals higher than |2.0|. The comparisons between the distributions of answers across age groups in 1996 and 2009 were made through the Kruskal Wallis test.

Table 5. Self-evaluation of the skills in PC use in 1996 and 2009 (%)

In response to RQ3, we see from Table 5 that adolescents first of all were not at the cutting edge of computer skills in 1996. They did not differ significantly from the other age groups. Only the elderly stood out from the rest reporting more often that they do not know how to use a computer (13.4 %). Thirteen years later, adolescents had improved their competence, with over 50 per cent recognizing themselves as ‘quite good’, in the same way as youth. However, youth and young adults more often than adolescents described themselves as being ‘expert at using the computer’.

In 2009, there was a polarization between the various age groups. Adults and the elderly, more than the others, declared that they ‘can get by’ with computers (st.res. 2.0 and 5.9). Adolescents and youth stated that they were quite good (st. res. 2.6 and 4.3), while again youth, but this time with young adults considered themselves expert in using computers (st.res. 2.0 and 2.0). This result again contradicts the bulk of research and public debates arguing that adolescents were at the top of capability to use digital technologies.

At this point in order to grasp the overall trend of the self-evaluation of computer skills, we treated this as a continuous measurement scale and attributed the value 1 to ‘don’t know how to use it’, 2 to ‘I can get by’, 3 to ‘quite good’ and 4 to ‘expert at using the computer’. It turned out that the average was 2.58 in 1996 and 2.51 in 2009. Comparing the averages of the two samples with the classic t-test, it is seen that they are statistically different ($p=0.001$) and that therefore the self-perception of computer use skills has decreased with time.

Discussion and final remarks

The present study produces several important findings on the history of adoption and use of new technologies in Europe. First of all, it was found that the first digital generation of adolescents was at the top of mobile phone and computer possession, but

not in terms of Internet access, in 1996. By contrast, with the rise of the second digital generation, adolescents lost their leading position in favour of youth and young adults in 2009. This might account for adolescents' taken-for-granted attitude towards these technologies, the issue that was only recognized in the 21st century (Ling, 2012). Due to this attitude the adolescents of the second digital generation may lack the same genuine interest and deep immersion in digital technologies that characterised adolescents in the late 1990s. Concerning the use of these technologies, adolescents were not at the cutting edge either in 1996 or in 2009. However, they showed only very modest progress regarding use of the mobile phone, but were in second place after youth in terms of SMS texting and Internet use. In addition, adolescents' computer skills increased comparatively less than the skills of youth-and young adults between 1996 and 2009. These observations lead us to conclude that adolescents lost their dominant position in the adoption and use during the period studied. It also makes us think that perhaps Prensky and others overlooked the implications of growing up with technology, since 1990s adolescents – who were also partly digital immigrants and in some countries more than in others – were inspired to become pioneers.

This main result calls for more detailed interpretation and discussion through the concept of generation. Among many competing notions of generation, the one that best captures this phenomenon is Mannheim's definition, in which generation includes all

individuals who were born within a certain period of time and thus were exposed to the same historical events and cultural context. It is evident that our observations about the first and second digital generations in Europe do not comply with Prensky's technologically deterministic approach to the digital native generation. In the light of this study, the question of digital generations especially concerns adolescents, whose parents belonged to the generation that was politically active in the 1960–70s (e.g. '68 movement). This first digital generation itself witnessed a very particular moment of effervescence, to borrow a Durkheimian term, which included a wide range of crucial political events, such as the fall of the Berlin Wall and the collapse of the Soviet Union. In these times, young Europeans experienced a far-reaching redesign of the European political landscape and came across with a new sense of transnational identity (Fortunati, 2009). It is the adolescents of the 1996 data, who formed the backbone of the first digital generation, that over the studied thirteen years grew up and can be found among the young adults in the 2009 data. This means that the adolescents of the 1996 data continue to be, in 2009, at the cutting edge along with youth, who belong to another, second digital generation that deserves further investigation in the future.

These results lead us to propose an approach to the notion of generation not as we know it. As we mentioned at the beginning, instead of applying a cohort approach from 1996

to 2009, we designed the study around age groups, having generation as the guiding principle to which we returned for further discussion here in the conclusions.

In the light of our findings, Prensky's notion of digital natives as those 'born with a technology' is challenged by opposing forces which annul each other. For example, while it seems to be the case that those born with new technologies have less fear of new technologies than older generations, it is similarly true that they take these new technologies more for granted (Ling, 2012) than older generations. In this way, technologies become less attractive to them, and young users seem to have less curiosity to develop the required capabilities to use them in advanced ways. The acquisition of higher proficiency in ICT use is probably no longer as necessary for adolescents as it was in 1996, due to more intuitive user interfaces and similarities between various devices and platforms.

It can even be presented that the adolescents of the 2009 data, who should correspond well to Prensky's generation of digital natives, are digitally more indifferent than the previous generation. This resonates with a series of recent studies showing that the second digital generation continues to appreciate reading on paper especially, and lacks the skills that would support the shift to reading and writing digitally (Fortunati and Vincent, 2014; Taipale, 2014, 2015). In addition, the second digital generation has not

received the information and training needed to use digital technologies (Herold, 2012). This refers to the insufficient realization of ambitious political goals that have aimed to increase information literacy in Europe (e.g. the Lisbon treaty) and beyond (Lankshear and Knobel, 2008; Eshet-Alkalai and Chajut, 2009). Compared with the early adopters of the first digital generation, who were a relatively small and internally coherent group, the second digital generation has faced the plight of both a fragmented social learning process and the beginning of formal education on digital technologies. All this explains well why the overall self-perception of computer use skills decreased between 1996 and 2009.

The adolescents of the second digital generation were clearly different from those who encountered ICTs 13 years earlier, because the world in which they lived had changed considerably. Between 1996 and 2009, instability and insecurity of both work and family were amplified. Europe also underwent several seminal processes, such as the impoverishment of societies and the crisis of education systems. Even living in big cities became much more challenging and expensive for young people. For these reasons, the second digital generation started from a comparatively lower level of advantage than its predecessors. It seems to have comparatively less social power which is not compensated by the technological empowerment that the broad diffusion of digital technologies has brought along (Fortunati, 2014).

The present study gives reasons to argue that the appropriation of digital technologies by different generations is a nonlinear and nonprogressive process (Taipale et al., 2017). Digital generations are influenced by power structures that react in different ways to the digitalization of society, with the consequence that maybe the younger generations become more powerful digitally, but not more powerful socially than older generations (e.g. high levels of unemployment, precarious jobs, more dependent on family). In general, the effects of time periods on the adoption and use of digital technologies among different generations have not attracted much scholarly attention. Our study also showed that adults rated their ICT skills lower than adolescents and youth, probably because the several constraints posed by work and family responsibilities inhibit a deeper engagement with new technologies. By contrast, the elderly are catching the adults up, at least, in the adoption and use of the mobile phone (e.g. Sarrica et al., 2014). They are narrowing this technological gap between age groups and arriving at a technological effervescence. It is also worth noting that between 1996 and 2009 it was especially youth and young adults who became the groups that most owned and most used new technologies. The question of digital generations is hence clearly a process of doing and becoming a generation.

Moreover, according to the present study, it is not always the case that a new generation begins and builds upon the preceding generation. We found that the adolescents of the second digital generation were less equipped and skilful in using digital technologies that the adolescents of the first digital generation. This does not mean the new generations are totally indifferent to acquiring computer skills, but they are probably developing diverse digital skills, such as those related to social media use. These skills are maybe more beneficial and convenient in their life, which is more strongly affected by family and peer isolation than the life of preceding generations. One obvious limit of this study is that, as the measures and data sets used are limited in scope and in time, we were not able to detect, for example, important generational differences in the use of social media and mobile internet access.

The results can be considered important as they show how age groups and generations are related to each other in rather nuanced ways in the context of digital technology adoption and use. While early accounts of Prensky, Tapscott and others rightly raised the issue of generational differences in the perception and use of digital technologies, our study took this line of research one step further, questioning the existence of a single coherent digital generation. Our data provided reasons to speak about at least two different digital generations. Nevertheless, the study also raised several questions for future studies. Why did the technological appropriation in which the adolescents of the

first digital generation were protagonists not empower them in the labour market? Why did this appropriation not lead them to greater knowledge and competence at an educational level, yet was able to raise the overall cultural level of society? These questions have remained largely unanswered since the studies on digital generations have made only little efforts to discuss their findings in the context of major sociological categories. We argue that this is a fundamental task for social scientists, who can shed light on the major social changes underlying the attitudes and behaviors of digital generations only by broadening up their interpretative frameworks.

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Endnotes

[1] To simplify the language used here, the terms ‘EU5’ and ‘Europeans’ indicate these five countries and their populations.

[2] We decided to use the measures of possession instead of the actual use for various reasons, although we are aware of the limitations of the chosen measures (for instance, the predictive capacity of a variable can be relatively low if the possession rate is high). The reasons are: 1) as the patterns of new media usage multiplied between 1996 and 2009 owing to the increase in the technical capability of ICTs, the measures of usage applied in the two surveys were different; 2) instead, it was quite possible to sustain over time the answering choices for new media possession; 3) including various measures of the use of these media, of which there are actually very many (e.g. number of calls made/received, sent/received SMSs, the duration of the calls), would make the analyses themselves less manageable; 4) the possession of devices correlates with actual usage.

References

Aassve A, Billari F, Mazzuco S and Fausta O (2002) Leaving home: A comparative analysis of ECHP data. *Journal of European Social Policy* 12(1): 259–275.

Becker H C (2000) Who's wired and who's not: Children's access to and use of computer technology. *The Future of Children* 10(2): 44–75

Bennett S, Maton K and Kervin L (2008) The ‘digital natives’ debate: A critical review of the evidence. *British Journal of Educational Technology* 39(5): 775–786.

Bérubé M and Nelson C (eds.) (1995) *Higher Education under Fire: Politics, Economics, and the Crisis of the Humanities*. New York: Routledge.

Billari FC, Philipov D and Baizán P (2001) Leaving home in Europe: The experience of cohorts born around 1960. *International Journal of Population Geography* 7(5): 1099–1220.

Bornstein K (1994) *Gender Outlaw: On Men, Women and the Rest of Us*. New York: Routledge.

Butler J (1990) *Gender Trouble: Feminism and the Subversion of Identity*. London: Routledge.

Churchill H and Clarke K (2010) Investing in parenting education: A critical review of policy and provision in England. *Social Policy and Society* 9(1): 39–53.

Comunello F, Ardèvol M F, Mulargia S and Belotti F (2016) Women, youth and everything else: Age-based and gendered stereotypes in relation to digital technology among elderly Italian mobile phone users. *Media, Culture & Society*. Epub ahead of print 20 October 2016

Edmunds J and Turner B (2002) *Generational Consciousness, Narratives and Politics*. New York: Rowman & Littlefield.

Eshet-Alkalai Y and Chajut E (2009) Changes over time in digital literacy. *CyberPsychology & Behavior* 12(6): 713–715. DOI: 10.1089/cpb.2008.0264.

EuroStat (2013) *Unemployment and Beyond*. Available at: http://ec.europa.eu/eurostat/statistics-explained/index.php/Unemployment_and_beyond (accessed 17 May 2013).

Fortunati L (2009) Gender and the mobile phone. In: Goggin G and Hjorth L (eds) *Mobile Technologies: From Telecommunications to Media*. London/New York: Routledge, pp 23–34.

Fortunati L (2014) Media between power and empowerment: Can we resolve this dilemma? *The Information Society: An International Journal* 30(3): 169–183.

Fortunati L and Taipale S (2013) The diffusion and use of information and communication technologies and the city from 1996 to 2009. *First Monday* 11(4). DOI: 10.5210/fm.v18i11.4960

Fortunati L and Vincent J (2014) Sociological insights on the comparison of writing/reading on paper with writing/reading digitally. *Telematics and Informatics* 31(1): 39–51.

Giusti E and Mannuncci C (2000) *Figli unici. Psicologia dei vantaggi e dei limiti.* Roma: Armando Editore.

Glotz P, Berschi S and Locke C (eds.) (2005) *Thumb Culture. The Meaning of Mobile Phones for Society.* Bielefeld: Transcript Verlag.

Gomez R and Camacho K (2013) Users of ICT at public access centers: Age, education, gender, and income differences in users. In: Chhabra S (ed.) *ICT Influences on Human Development, Interaction, and Collaboration*, Hershey, PA: Information Science Reference, pp. 1–21.

Hargittai E (2002) Second-level digital divide: Differences in people's online skills. *First Monday* 7(1).

Hargittai E (2010) Digital na(t)ives? Variation in Internet skills and uses among members of the 'Net Generation'. *Sociological Inquiry* 80(1): 92–113.

Hargittai E and Hinnant A (2008) Digital inequality: Differences in young adults' use of the Internet. *Communication Research* 35: 602–621.

Helsper EJ (2010) Gendered Internet use across generations and life stages. *Communication Research* 37(3): 352–374.

Helsper EJ and Eynon R (2010) Digital natives: Where is the evidence? *British Educational Research Journal* 36(3): 503–520.

Herold DK (2012). Digital na(t)ives: Discourses of exclusion in an inclusive society. In: Loos E, Haddon L and Mante-Meijer E (eds) *Generational Use of New Media* (eds. E Loos, L Haddon and E Mante-Meijer). Farnham and Burlington: Ashgate, pp. 71–87.

Holdsworth C (2000) Leaving home in Britain and Spain. *European Sociological Review* 16(2): 201–222.

Holmes D (1999) Adolescent CIT Use: Paradigm shifts for educational and cultural practices? *British Journal of Sociology of Education* 20(1): 69–78.

Jones C, Ramanau R, Cross S and Healing G (2010) Net generation or digital natives: Is there a distinct new generation entering university? *Computers & Education* 54(2): 722–732.

Katz E and Aakhus M (2002) *Perpetual Contact: Mobile Communication, Private Talk, Public Performance.* Cambridge: Cambridge University Press.

Lankshear C and Knobel M (2008) *Digital Literacies: Concepts, Policies and Practices*. New York: Peter Lang.

Law P-L (ed.) (2012) *New Connectivities in China. Virtual, Actual and Local Interactions.* Dordrecht: Springer.

Lewis J (2007) Teenagers and their parents: Parental time and parenting style − what are the issues? *The Political Quarterly* 78(2): 292–300.

Ling R (2004) *The Mobile Connection: The Cell Phone's Impact on Society.* Amsterdam: Morgan Kaufmann.

Ling R (2012) *Taken for Grantedness*: *The Infusion of the Mobile Phone in Society*. Cambridge: MIT Press.

Lutz W, Sanderson W and Scherbov S (2008) The coming acceleration of global population ageing. *Nature* 451: 716–719 (7 February 2008). DOI: 10.1038/nature06516.

Mannheim K (1952) The problem of generations. In: Mannheim K (ed. Paul Kecskemeti): K Mannheim, *Essays on the Sociology of Knowledge*. London: Routledge and Kegan Paul, pp. 276–320.

Moscovici S (1976) *Social Influence and Social Change*. London: Academic Press.

OECD (2013) *Education at a Glance 2013*. Available at: http://www.oecd.org/edu/eag2013%20(eng)--FINAL%2020%20June%202013.pdf (accessed 27 May 2015).

Pertierra R, Ugarte E, Pingol A, Hernandez J and Dacanay N L (2002) *Txt-ing Selves: Cellphones and Philippine Modernity*. Manila: De La Salle University Press.

Prensky M (2001a) Digital natives, digital immigrants. *On the Horizon* 9(5): 1–6. Available at: http://pirate.shu.edu/~deyrupma/digital%20immigrants,%20part%20I.pdf (accessed 20 December 2009).

Prensky M (2001b) Digital natives, digital immigrants, Part 2. *On the Horizon* 9(6): 1–6.

Riley MW (1987) On the significance of age in sociology. *American Sociological Review* 52(1): 1–14.

Santoro M (2004) Recenti trasformazioni dei processi di transizione all'età adulta in Europa. 9 Working paper del Dipartimento di Studi Sociali e Politici, Università

degli Studi di Milano. Available at: http://www.sociol.unimi.it/papers/santoro (accessed 29 May 2015)

Selwyn N and Bullon K (2000) Primary school children's use of ICT. *British Journal of Educational Technology* 31(4): 321–332.

Taipale S (2014) The affordances of reading/writing on paper and digitally in Finland. *Telematics and Informatics*, 32(4), 532–542. DOI: 10.1016/j.tele.2013.11.003

Taipale S (2015) Bodily dimensions of reading and writing practices on paper and digitally. *Telematics and Informatics* 32(4): 766–775.

Taipale S, Wilska T-A and Gilleard C (2017a) Introduction. In: Taipale S, Wilska T-A and Gilleard C. (eds.) Digital Technologies and Generational Identity: ICT Usage Across the Life Course. London: Routledge.

Tapscott D (1998) *Growing Up Digital: The Rise of the Net Generation.* New York: McGraw Hill.

Tapscott D (2008) *Grown Up Digital: How the Net Generation is Changing Your World*. New York: McGraw-Hill.

Taylor AS and Vincent J (2005) An SMS history: In: Hamill L., Lasen A., (eds.) *Mobile World Past, Present and Future*. Berlin: Springer, pp.75–92.

Tebano E (2013) Le nuove (mezze) stagioni della vita, *Corriere della Sera*, 29 Marzo, p. 31.