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Abstract

The aim of this paper is to investigate how the possession of computers and mobile phones and access to the Internet is influenced by micro and macro spatial dimensions and how Europeans have embedded the possession of these technologies into the spatial dimension of their daily life. We gathered our data from two telephone surveys carried out in five European countries (Italy, France, Spain, the UK and Germany) using a representative sample of their populations (N=6609 in 1996 and N=7255 in 2009). Both surveys were sponsored by Telecom Italia. To accurately represent the spatial dimensions of Europe we focused on four variables: house size, city size, socio-economic macro area and country. These variables were analyzed alongside computer and mobile phone ownership and Internet access. The results have allowed us to obtain new insights into how the spatial dimensions of European societies are related to the diffusion of computers, the Internet and mobile phones.

Keywords computer ownership, Internet access, mobile phone ownership, spatial dimensions, house size, city size, socio-economic European macro regions, Italy, France, Germany, Spain, the UK.

1 Introduction

The fact that space has always been an extremely significant factor in the process of communication is broadly acknowledged by the scientific community studying communication and information technologies [i.e. Thompson, [32]. However, usually one thinks of the concrete context in which the communication process takes place: sociological research projects in the last two decades have explored the usage of new media in the workplace (Fortunati, [9]; Pica & Sorensen, [26]), religious places (Katz, [20]), restaurants (Ling, [23]), trains (Fortunati, [11]), libraries (Hoeflich & Gebhardt & Rössler, [19]) , bars and cafés (Hoeflich, [16]) and so on. In addition, the context of mobility has been explored in contrast to inactivity (Lasch & Urry, [18]) as well as how ICTs have re-shaped towns (Aurigi, [1]; Hoeflich, [17, 18]; Kopoamaa, [21]; Townsend, [31]). The majority of these studies are however based on qualitative re- search, and so on data which cannot be generalized. The focus of many of the studies concerning different spatial contexts is the obser- vation of new explicit and implicit grammar rules that mediate behavior in the public space, by means of:

- new trajectories of micro and macro gestures;

- complexification of prossemics;

- -the co-existence and merging of actual and virtual dimensions in the communication process;

- restructuring good manners.

Taipale [29, 30] has recently put forward an in-depth analysis of the role of space in the communication process. This research contested a trope which often recurs in the current sociological literature concerning the mobile phone, contending that the mobile phone is a metropolitan, urban technology. In this paper we will focus on the role played by micro and macro spatial variables in the diffusion of new media, with the aim of understanding whether or not they influence the process of the diffusion of ICTs and to what extent. We will examine these variables in a situation in which it is possible to look at them all at once and inside a data set generated using a representative sample of five European populations.

Moreover, it may be useful to articulate the following two sub-research questions: 1) are these spatial variables all significant in influencing the diffusion of new media, or are there one or more variables which are significant and others that are not? and 2) do larger spatial dimensions possess an increased strength corresponding to their size when influencing the diffusion of new media? We will produce, where possible, a comparison between these two series of data (1996 and 2009) with the aim of understanding the main changes which occurred in these thirteen years in terms of the diffusion of these three technologies in Europe and in terms of the relationship between these technologies and European spatial dimensions. This will allow us to gain insights into areas which are important in outlining the communication process, allowing us a better understanding of the complexity of this process.

1.1 Literature Review

In the past, several major social theorists such as Simmel [28] have pointed out the importance of space in the communication process; in particular, he proposed that the social space may be seen as being organized according to different kinds of hierarchies. Moles & Rohmes [24] proposed conceptualizing the space in terms of spatial shells, which are similar to concentric circles of growing spaciousness and which correspond to the different dimensions of space surrounding the individual: the space of the house is the first circle, the space of the neighborhood is the second, that of the town is the third, that of the region is the fourth and so on.

These two authors studied the manner in which the spatial shells reduced as the age of the individual increased. The outermost spatial shells (corresponding to the biggest distances) reduce around the elderly, and then, progressively, all the other ones follow. Among contemporary scholars, Castells et al. [2] analyzed the relationship between space and communication, distinguishing the space of places from the space of flows. In terms of the space of places, generally speaking, the concrete context in which communication takes place has been the most explored dimension. In contrast, as regards the space of flows, the context of mobility has been explored in relation to how ICTs re-shaped the towns (Kopomaa, [21]; Townsend, [31]) and finally in relation to how ICTs use reshaped the urban/rural dimension, for example, in China (Fortunati et al., [13]).

However the majority of these studies are based on qualitative research and so on data which is not generalizable. At the cross between the notion of space of places and of space of flows is found the analysis proposed by Fortunati [11], which promotes the human body as the place in which a complex system of communications occurs and in which specific practices of convergence of the new (and old) media take place and merge with other systems of communication (such as fashion and good manners). Taipale [30] recently proposed an in-depth analysis of the role of space in the communication process, producing quantitative and qualitative data regarding Finnish society. This shows that the old separation between a rural dimension deprived of technology and an urban dimension well equipped with technology does not exist anymore. But which are the primary issues within the current sociological debate concerning the relationship between space and new media? The main conclusions discussed and elaborated upon in the debate regarding the diffusion of computers, mobile phones and the Internet are as follows. There is a shared understanding that the social use of new media has:

- developed the double register of space-actual and virtual-to describe the increase in the communication space;

- introduced the new concept of absence/presence (Fortunati, [10]; Gergen, [15]) and the notion of imagined co-presence (Urry, [33]);

- deeply influenced the evolution of the human sensorium (Crang & Thrift, [3]).

In 2009, Forlano [7] published an interesting paper in which she stresses the need to develop new spatial categories at a conceptual level. In particular, she uses the concept of "codescapes" in order to describe a new analytical category that integrates both physical and digital spaces. We support this new definition since homes, offices and third places are increasingly layered with digital information networks. Furthermore, this new term "codescapes" allows us to better describe the process of the reconfiguration of people, places and information which is occurring in the contemporary media landscape. Another useful notion is that of spatial media, proposed by Shin [27]. Shin looks at technological artifacts as media which are able to create spatially differentiated social interactions also through immaterial, symbolic or affective elements. His notion of spatial media is useful, even more so if it is integrated with Sheppard's contribution [4]. Sheppard discusses spatial media in an original way, considering their relational features and seeing them as symbols which connect people and places. Traditionally, space has always been considered as a relational concept in the sense that humans acquire the notion of space through their relationship with other humans (initially, the mother).

However, Sheppard argues that spatial organization does not emerge out of a set of preconceived spatial categories such as place, space and territory. Rather, "it is an emergent result of how places are connected together". In addition, the context in which technological artifacts are accessed can help to define the connection between places, rather than the internal attributes of the places themselves. Therefore, spatial media are about how people and places are connected together at the same time. The studies that we mentioned concerning spaces as contexts were facilitated by the fact that concrete contexts are easier to investigate and that their influence is also more evident. The importance of these studies is undeniable, but they do not tell us to what extent space is important and the weight of spatial dimensions in the communication process. The role of less investigated spatial dimensions, such as the house size or the size of the urban and rural environment in which the mediated communication process takes place, as well as that of the region and of the country, is the object of this study. The theory that we intend to apply is that of spatial shells as proposed by Moles & Rohmer [24], but read in the light of Forlano's [7], Shin's [27] and Sheppard's [4] contributions.

Therefore, this study should be able to support a more complex notion of spatial shells, viewed as digital and physical spaces, characterized by different social interactions (mediated and non mediated) as well as symbolic and affective elements, and connected by multiple networks of relationships. The structure of this article is as follows: the next section is dedicated to the illustration of the method which has been used, then we will illustrate the results of the two research projects regarding the role of spatial variables –the size of the house, the city, the macro region and the country- on the ownership of new media. Then we will analyze the effects of the four spatial shells considered together. In the final sections, we will discuss the results and draw conclusions.

2 Method

We will present in this paper the results of two surveys carried out in the five most populous and industrialized European countries (France, Germany, Italy, Spain and the UK) in 1996 and 2009. The questionnaires were conducted via a phone survey (CATI), and consisted of 6609 subjects in 1996 and 7255 in 2009, involving in both cases a representative sample of the population. The purpose of these two surveys was very broad, but here we will present and discuss the data relating to the diffusion and adoption of new media (namely the computer, the Internet and the mobile phone). Consequently, we considered four micro and macro spatial variables and several socio-demographic variables.

The study which was conducted in 2009 partially replicated the research project carried out in 1996 [1] (Fortunati, [8]). A complete replication was not possible due to the fact that in 2009, Europe was faced with a new field of information and communication technology, so the

[1] To simplify the exposition we will use the term Europe and Europeans to indicate these five countries and their populations.

questionnaire had to be restructured. Furthermore, this is not a longitudinal study, since the samples were made up of different respondents. Telecom Italia financed both studies [2] . The demographic variables included in these research projects are gender, age, education, activity, family typology, income, house size (unfortunately only in the first survey), city size, socio-economic macro area and country. Among the respondents in 1996, 3,170 were male (48.0%) and 3,439 were female (52.0%), while in 2009, 3,551 were male (48.9 %) and 3,704 were female (51.1 %). The respondents' age was categorized into five groups (14-17, 18-24, 25-44, 45-64 and 65 years and over). Level of education was divided into the following categories: low (primary and secondary school diploma), middle (high school diploma) and high (College/University degree or higher). Respondents' occupational classifications included persons who were employed, unemployed, housewives, students and retired.

The typology of families consisted of single people, couples without children, couples with children, single-parent families and mixed families (all the other types of families). Income, with regards to the 1996 survey, was divided into three categories for each different currency, but they were all equivalent to the values adopted in 2009. In 2009 these values corresponded to: 20-30,000 euros per year (low); 30,001-60,000 euros per year (middle) and 60,001 or more euros per year (high). Finally, the spatial variables investigated were the house, the city, the macro region and the country. The question regarding house size, which was investigated only in 1996, had to be structured in a different way in the UK ("How many living and bedrooms do you have?") and in all the other countries ("What is the surface area of your home?"), since this variable required information which is given in a different way in various cultures. In particular, while in all the continental countries people were accustomed to stating the dimensions of their house in square meters (sqm), in the UK people were accustomed to describing the dimensions of their house using the number of rooms. In order to have a consistent variable, we estimated the dimensions of a room at an average of 16 square meters, so that it was possible to discern a unitary answer for all the respondents. However, this variable must be treated with great caution. Five categories were outlined with respect to city size[3] , while the macro regions in the various countries included groups of regions which form a homogeneous socio- economic system[4] .

The analyses which are reported here are monovariate (frequencies), bivariate (cross-tabulations) and multivariate (logistic regression analyses). In particular, when the χ 2 test was significant in the bivariate analyses, standardized residuals were considered [5] . In respect to the

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[2] In this study a weighted dataset was used in order to correct some distortions (related to age, education and ownership of the computer and access to the Internet) which affected the correct representation of the various quotas of the sample.

[3] In 1996 the categories were as follows: up to 20,000, 20,000-50,000, 50,000-100,000, 100,000-500,000 and 500,000 and more, but the answers did not include British respondents since they found very difficult to answer to this question; in 2009 they were: up to10,000, 10,000-30,000, 30,000-100,000, 100,000-500,000 and 500,000 and more. Thankfully, in 2009 British respondents did not find any difficult in answering to this question (for more information, see the paragraph "The second spatial shell: the city size").

[4] As for the macro regions, in Italy they include the following regions: North West = Piemonte, Lombardia, Val d'Aosta and Liguria; North East = Veneto, Friuli Venezia Giulia, Trentino Alto Adige and Emilia Romagna; Centre = Toscana, Umbria, Marche and Lazio; South = Abbruzzo, Molise, Puglia, Basilicata, Calabria, Campania, Sicilia and Sardegna. In France Centre / North East = Centre East, North, East, BP East; Paris = IDF; South = Mediterannée, South East; North West = West, BP West. In Germany N1 = Schleswig-Holstein, Hamburg, Bremen, Niedersachsen; N2 = Nordrhein-Westfalen; N3A+N3B = Hessen, Rheinland-Pfalz, Saarland, Baden-Württemberg; N4 = Bayern; N5+N6+N7 = Berlin, Brandenburg, Mecklenburg-Vorpommern, Sachsen-Anhalt, Sachsen, Thüringen. In the UK, North = North West, Yorkshire, North East; Scotland / N Ireland= Scotland, Northen Ireland, Border; Midlands = Midlands; South East Anglia = London, South & South East, East; Wales / South West= Wales & West, South West. In Spain North West = Galicia, Asturias, Cantabria, Pais Basco, Castilla y Leon, La Rioja, Navarra; North East = Catalunia, Aragon; Centre = Madrid, Castilla la Mancha, Extremadura; East = Comunidad Valenciana, Murcia, Baleares; South = Andalucia and Canarias.

[5] The analysis of standardized residuals is based on the identification of the cells of a contin- gency table which are responsible for a significant overall chi square. Values outside of +/- 1.96 are considered as statistically significant (e.g. Everett, [5]; Field, [6]). However to simplify the analysis we will read only the positive residuals with the purpose to

regression analyses, the Hosmer & Lemeshow test was used to verify the goodness-of-fit of the models. Three dichotomous questions about computer and mobile phone ownership, as well as Internet access, were used as dependent variables.

3 Results

3.1 The First Spatial Shell: House Size

Let us begin the analysis of the spatial shells with house size: the modal class for the size of a house within our five countries was from 50 to 99 sqm, as 42.8% of Europeans in 1996 were living in houses of these dimensions. Only a very limited section of our respondents (9.0%) lived in mini or midi apartments. The UK was the European country with the highest percentage of very small apartments (31.1%). The most common house size between 50 and 99 sqm– was most frequent in the UK and Germany, where it applied to respectively 60.3% and 47.4% of the respondents. Houses between 100 and 120 sqm were more common in Italy (31.1%), while a significant number of houses from 121 to 199 sqm were concentrated in Germany (18.1%) and again in Italy (14.9%).

Finally, houses measuring 200 sqm or more were more wide- spread in France (30.1%), in Spain (26.4%) and in Italy (19.8%). Moving on now to analyze how house size was distributed within the socio economic macro areas of these five countries, it emerged that the smallest houses were significantly more widespread in all the British macro areas, and also in the French macro area of the Paris region. Houses between 50 and 99 sqm, which we observed to be the most common size in Europe, were concentrated particularly in the German macro areas N2 and N5 and in all the British macro areas. Houses from 100 to 120 sqm were instead prevalent within all the macro areas of Italy and in the German macro area N4. Houses between 121 and 199 sqm were located particularly within all the German macro regions, except the N5+N6+N7, as well as in the South and North West of Italy.

Finally, big houses (200 sqm or more) were present particularly in all the French macro areas, in the South of Italy and in all the Spanish macro areas, except the North East. Looking now at how house size interacted with city size, it emerged that the size of the house was inversely proportional to city size (Spearman's rank correlation coefficient = -0.218, significant at 0.01). In fact, 43.0% of the houses between 100 and 120 sqm and 52.7% of those of 200 sqm or more were present in smaller centers with up to 20,000 inhabitants, while 33.9% of mini apartments up to 49 sqm were found in the big cities with at least 500,000 inhabitants, Finally, 19.1% of midi apartments from 50 to 99 sqm appeared in cities of medium size (from 100,000 to 500,000 inhabitants), and 20.4% appeared in big cities with 500,000 inhabitants or more. In 1996 the diffusion of the internet was not influenced by the size of the house in which the respondent lived; however, computer and mobile phone diffusion was. The computer was much more embedded in everyday life than the mobile phone, which was still in its early stages (33.2% of the population had a computer, versus 15.3% with mobile phones).

Moreover, these data show that house size had a significant influence on computer and mobile phone ownership which was predominantly concentrated in large apartments from 121 to 199 sqm.

3.2 The Second Spatial Shell: City Size

It is interesting to report the different dimensions of city size in 1996 and 2009 as they appear from the surveys. Three caveats must be made explicit from the beginning: 1) some of the

see in which cell the relation was positive. These residuals are reported in the following tables with an asterisk when their values are more than 1.96.

categories used are different and so the data are not strictly comparable; 2) in the first collection of data, answers from the UK are lacking, since British respondents found it very difficult to answer this question given the different organization of the rural-urban continuum in their country. Thankfully, 13 years later respondents did not experience too many difficulties in answering (886 answers over 1411 respondents); 3) the high number of missing answers to this question should not come as a surprise, as many people do not even have a vague idea of the number of inhabitants who live in their city.

Despite these caveats, this data is able to provide a sense of the changes undergone in the organization of the European habitat. If we analyze city size in the European macro areas, it emerges that in 1996 the highest percentage of respondents lived in rural villages (up to 20,000 inhabitants) was related to the North West of Italy and to the macro areas of France such as the North West, the Center/North East and the South. Respondents living in small centers (20,000–50,000 inhabitants) were located primarily in the Paris area and in Germany, in particular in the areas of N3A+N3B, N4 and N1. Respondents living in small cities (50,000-100,000 inhabitants) were more likely to be found in the South and Center of Italy and in the German areas N2 and N1. Respondents living in middle cities (100,000–500,000 inhabitants) were more likely to live in the German macro area N2 and in all the Spanish macro areas except the North East. Finally, respondents living in big cities (more than 500,000 inhabitants) were more likely to stay in the North East of Italy, in the Paris area, in the German macro areas N2, N5+N6+N7 and N1 and in the Center and North East of Spain.

In 2009, respondents living in rural villages (up to 10,000 inhabitants) were located particularly in the North West, North East and South of Italy, in all the German macro areas except N2, and in the North West and the Center/North East of France. People living in small centers (10,000–30,000 inhabitants) were situated in the South, North East and North West of Italy, followed by the German N4 and N3A+N3B. Respondents living in small cities (30,000-100,000 inhabitants) were more likely to be found in the South, North East and Center of Italy, in the East, South and North West of Spain and in the German area N2. People living in medium cities (100,000-500,000 inhabitants) were particularly present in all the British macro regions. Finally, respondents living in big cities (more than 500,000 inhabitants) were more likely to stay in the Paris area and in the South of France, in the South East/Anglia, and in the centre of Spain. Finally, at a more macro level, city size in the five countries in 1996 and 2009 demonstrates a change that occurred in Europe because of the general progression of urbanization. In 1996, the rural way of living was more widespread in France and in Italy, and the small provincial cities were more commonly found in Germany.

The intermediate size cities were more common in Germany and Italy, while Spain appeared to be grounded in the larger dimensions of urbanity. But if we look at 2009, the highest presence of small centers up to 10,000 and from 10,000 to 30,000 was in Italy and in Germany. The small cities with 30,000 to 100,000 inhabitants were more common in Spain and in Italy. The middle sized city was more common in the UK, while the highest presence of big cities was registered in France, followed by Spain. Germany, which in 1996 was made up primarily of medium sized and big cities, in 2009 appeared to have revised its strategy of the habitat, with a strong concentration of small cities with up to 30,000 inhabitants and medium cities from 100,000 to 500,000 inhabitants.

On this last dimension also the UK tends to have a strong concentration of small cities, like Germany, while Spain, which in 1996 was particularly rich in cities with 100,000 inhabitants and over, in 2009 appeared to have more cities with 30,000 to 100,000 inhabitants or more. Ownership of computers, mobile phones and access to the Internet relate in different ways to the spatial dimensions of the city, both because they are technologies which have a different structural relation with the space surrounding them and because our observations were based in two periods when the diffusion of said technologies was in two very different stages. The computer was more established in Europe at the time of the first survey, while the mobile phone was in the second stage of its diffusion and the Internet was just at its beginning. Let us start with the computer.

From this data it is clear how the diffusion of the computer in these five countries has been influenced by city size and continues to be influenced now. In particular, in 1996, computer ownership was significantly lower in the small centers and significantly higher in the cities with 500,000 inhabitants or more. It is well known that in the case of the computer the social learning process was vital, that is, support by friends and colleagues in learning how to deal with the device (see also Williams, Stewart & Slack, [34]). In 2009 there was only a general association between city size and computer ownership. With regards to the diffusion of the mobile phone, neither in 1996 nor in 2009 was the diffusion of this technology influenced by city size. Perhaps this related to the fact that being an individual, personal tool, mobile phone ownership is less likely to relate to the different spatial dimensions of the social sphere. Furthermore, the fact that a mobile phone is cheaper to buy than a computer, and that the expenses for its use are easily controllable thanks to prepaid cards, has freed it from the spatial characteristics of the rural/urban habitat.

Finally, let us analyze the diffusion of Internet access. As expected, Internet access in 1996 was more concentrated in cities with 500,000 or more inhabitants, while being far less in the small centers. This may be due to infrastructure problems, in addition to social learning problems, and the high costs involved for families. Thirteen years later, a general association between city size and Internet access persists, but without any specific relationship to different sized cities.

3.3 The Third and Fourth Spatial Shells: European Macro Areas and Countries

In this paragraph we will not perform a descriptive analysis of the interactions between all European macro areas and the five countries surveyed in 1996 and 2009 because of length restrictions and because more in-depth analysis of this area was possible through the logistic regression that we will present in the following paragraphs. With regards to Europe in 1996, the mobile phone was significantly more widespread in all the Italian macro areas and in some British macro regions such as South East/Anglia, the North and the Midlands. As regards the computer, this device was more common in the German N2, N3A+N3B, N4, in South East/Anglia and the North East of Spain. Internet access was more widespread in South East/Anglia, the North and the Midlands in the UK, and in the German area N2. With regards to the situation in Europe in 2009, the highest concentration of mobile phones was in the South and the Center of Italy. The computer was significantly more widespread in the North of the UK and Internet access was more widespread in all the macro areas of Germany, except N5+N6+N7. Regarding the diffusion of the computer, the mobile phone and Internet access in 1996 among the five countries being considered, Italy was the one in which the mobile phone was most widespread, followed by the UK. Germany and the UK had the highest percentage of computer owners, and the UK was at the top for Internet access. In 2009, Italy continued to be at first place in terms of the diffusion of the mobile phone, followed by the UK. France was in top place in terms of computer ownership, while Germany and then France had the highest internet access.

3.4 Analysis of the Effects of the Four Spatial Shells Considered Altogether

Table 1 represents the results of a series of logistic regressions that we conducted with the aim of verifying whether or not in 1996 and 2009 spatial dimensions such as

Table 1. Ownership of computer, Internet and mobile phone in Europe in 1996 and 2009: odds ratios and Hosmer-Lemeshow test significance per each model

	Computer		Internet		Mobile phone	
	1996	2009	1996	2009	1996	2009
Country. ref: Italy						
France	0.402***	1.502	0.756	1.695*	0.379***	0.169***
Germany	1.383	2.434***	0.653	3.720***	0.408**	0.179***
Spain	0.597*	1.019	0.663	1.138	0.467*	0.539
United Kingdom		3.164**		3.228***		0.381*
Age. ref: 25-44						
14-17	0.878	1.476	1.150	1.138	1.820*	0.864
18-24	0.834	1.725**	1.087	1.307*	1.201	1.528
45-64	0.922	0.734**	0.690	0.804**	0.823	0.455***
65+	0.369***	0.366***	1.499	0.410***	0.685	0.374***
Education. ref: Low edu.						
Medium education	1.869***	2.197***	1.185	2.019***	1.129	1.692***
High education	3.708***	3.607***	2.799**	3.296***	1.643***	1.871***
Gender. ref: Females						
Males	1.805***	1.559***	1.471	1.395***	1.217*	1.579***

Table 1. (*Continued*)

Activity. ref: Workers						
Unemployed	0.894	0.378***	0.787	0.492***	0.379***	0.551**
Retired	0.558***	0.297***	0.078**	0.358***	0.357***	0.354***
Student	1.881***	1.433	0.968	1.343	0.610**	1.194
Housewife	1.209	0.624***	1.815	0.686**	0.941	0.452***
Family. ref. Couple with children						
Couple without children	0.562***	0.459***	1.431	0.525***	1.197	1.196
Single	0.445***	0.303***	0.926	0.357***	0.705	0.700**
Single parent family	0.743	0.695*	1.568	0.613**	1.623*	0.946
Mixed family	0.894	0.519***	1.189	0.559***	1.329*	0.708*
City size. ref: Up to 10 or 20.000						
20.000-50.000	1.281*		1.961		1.268	
10.000-30.000		0.989		1.178		0.930
50.000-100.000	1.135		2.475*		1.218	
30.000-100.000		1.114		1.048		0.872
100.000-500.000	1.415**	0.983	2.198	0.958	1.181	0.712**
500.000+	1.297	1.096	2.702*	1.144	0.980	0.966
House size. ref: 50-99 sqm						
From 10 to 49 sqm	*0.586**		*0.565*		*0.767*	
From 100 to 120 sqm	*1.317***		*2.325***		*1.312**	
From 121 to 199 sqm	*2.043****		*2.753***		*1.879****	
200 and more sqm	*1.706****		*2.112**		*1.527***	
Macro regions. ref: NW of Italy						
Italy NE	*0.649**	*0.693*	*0.272*	*0.820*	*1.343*	*0.806*
Italy Centre	*0.750*	*0.715*	*0.851*	*0.870*	*0.943*	*1.625*
Italy South	*0.386****	*0.585***	*0.217*	*0.586***	*0.931*	*0.802*
France Paris	*1.457*		*1.533*		*1.655*	
France NW	*1.171*	*1.272*	*0.577*	*1.191*	*1.411*	*1.098*
France Centre/NE	*1.251*	*1.019*	*1.929*	*1.058*	*1.420*	*0.794*
France South		*1.141*		*1.115*		*1.261*
Germany N1	*0.689*	*0.779*	*2.434*	*0.767*	*0.949*	*0.867*
Germany N2	*1.068*	*0.885*	*2.958*	*0.854*	*0.795*	*1.210*
Germany N3A+N3B	*1.131*	*0.820*	*1.841*	*0.815*	*1.060*	*0.945*
Germany N5+N6+N7	*0.593**	*0.474****	*1.156*	*0.412****	*0.641*	*1.470*
UK North		*0.834*		*0.806*		*1.669*
UK Wales/SW		*0.703*		*0.754*		*1.793*
UK Midlands		*0.426**		*0.495**		*0.793*
UK SE/Anglia		*0.339***		*0.385***		*0.936*
Spain NW		*1.154*		*1.325*		*0.643*
Spain NE	*2.234***		*1.128*		*1.790*	
Spain East	*1.103*	*1.333*	*0.640*	*1.410*	*0.961*	*0.542*
Spain South	*0.960*	*1.091*	*0.219*	*1.097*	*0.729*	*0.670*
Spain Centre	*1.506*	*1.707*	*1.927*	*1.354*	*0.766*	*0.476**
Hosmer-Lemeshow test sig.	*0.781*	*>0.000*	*0.683*	*>0.000*	*0.095*	*0.203*

Sig.: * = p<0.05, ** = p<0.01, *** = p < 0.001. The statistical software used for these analyses was STATA.

house size, the size of the city of residence, geographical macro areas, and country, considered altogether, influenced the diffusion of the computer, the Internet and the mobile phone in Europe, once gender, age, education, family typology and activity were controlled. Results in Table 1 show that in 1996 the computer was the more sensitive technology to spatial variables, since the ownership of this device was influenced by all the spatial variables: house size, city size, macro regions and country. Respondents living in mini apartments possessed a computer in fewer cases than those living in houses from 50 to 99 sqm.

For the rest of the respondents, the bigger the surface area of the house, the higher the probability that those living there owned a computer. The exception was those living in houses of 200 or more sqm, who had a lower probability of computer ownership than those living in houses of 121 to 199 sqm. This probably means that back in 1996, the computer still required a considerable space in a house in order to be accommodated. In addition, the size of the city mattered: the bigger the city, the most likely it was that the inhabitants owned a computer. However, there was not a progressive increase, since cities with between 50,000 and 100,000 inhabitants do not appear to act as attractive, spatial infrastructures for the diffusion of the computer, and nor do the biggest cities.

Furthermore, the diffusion of the computer was also sensitive to the macro regions: the Italian North East and South were strongly behind on computer ownership, as well as the German macro area composed of N5+N6+N7, while the North East of Spain was far ahead. However, on the whole, France and Spain had, at that time, fewer computer owners than Italy and the other countries. Apart from the spatial variables, the structural variables which were significant in the model were gender (more males than females had a computer), age (elderly people from 65+ had fewer computers than the younger respondents), education (the higher the level of education, the more likely were respondents to own a computer), activity (retired people had fewer computers and students had more) and finally the family typology, as respondents living in families composed of couples without children or single families had fewer computers.

The Internet in Europe in 1996 was not reacting to macro spatial variables such as country or macro region but only to the micro ones: house size and city size. As we previously noted for the computer, respondents living in houses of 100 sqm or more were more likely to be able to access the Internet. With regards to city size, the larger concentration of Internet connections was in small cities of 50,000-100,000 inhabitants and in big cities (from 500,000 upwards). In addition to the spatial variables, only two structural variables were significant: education (a high level of education increased the probability of Internet access) and activity, in the sense that being retired dramatically lowered the likelihood of Internet access. Mobile phone ownership in Europe in 1996 was influenced by country and house size, but not city size or macro regions. France, Germany and Spain had fewer mobile phones than Italy and, as with computer ownership and Internet access, respondents living in houses of 100 sqm or more had a higher probability of owning a mobile.

Several structural variables were significant: gender (males were more likely to possess a mobile phone than females) and age (the youngest respondents from 14 to 17 years old were more likely to possess a mobile than all the other respondents). A high level of education increased the probability of mobile ownership, and people who were unemployed, retired or students had fewer mobiles than workers. Finally, respondents living in single-parent families and mixed families were more likely to possess a mobile phone than those living in all the other kinds of families. In 2009 the situation in Europe is quite different; these logistic regressions, according to the Hosmer & Lemeshow test, do not seem to fit the data anymore, at least in terms of providing an explanation for computer ownership or Internet access.

Evidently, there are other variables intervening that were not accounted for in the 2009 survey. Computer ownership is more widespread in Germany and the UK than in Italy. In the South of Italy as well as in the N5+N6+N7 areas of Germany, and in the Midlands and the South East/Anglia of the UK, computer ownership is less widespread than in the North West of Italy. Young people between 18 and 24 years old are more likely to possess a computer than respondents of age 25-44, while respondents of 45 years old are even less likely to own a computer (the likelihood continues to decrease with age). Males have a higher probability than females of owning a computer, and the more educated a person is, the more likely he/she is to have a computer. Housewives and people who are unemployed or retired are still less likely than workers to possess a computer. Finally, respondents living in all the other different families typologies have a lower probability of having a computer than those living in families composed of a couple with children.

As regards the Internet, Germany, the UK and France are more likely to have Internet access than Italy. The South of Italy, the N5+N6+N7 areas of Germany and the Midlands and the South East/Anglia areas of the UK are less likely to have Internet access than the North West of Italy.

Young respondents between 18 and 24 years have a higher probability of having Internet access than those from 25 to 44 years old, while respondents from 45 years onwards have a lower probability. As the level of education increases, more respondents are found to have access to the Internet. Males have a higher probability than females of having a connection to the Internet. Housewives and people who are unemployed and retired are still less likely to have access to the Internet than workers, and respondents living in all the different families typologies have a lower probability of Internet access than those living in families composed of a couple with children. In terms of mobile phones, the probability that respondents would own a mobile was lower in Germany, France and the UK than in Italy.

The macro region where inhabitants are least likely to have a mobile is the Center of Spain. A city of 100,000- 500,000 inhabitants has a lower probability of mobile phone ownership than the smallest town with under 10,000 inhabitants. Respondents of 45 years and older have a lower probability of owning a mobile than respondents of 25-44, and the elderly are even less likely to do so. The more education a person has received increases the likelihood that they will have a mobile. Males have a higher probability than females of possessing a mobile phone and a higher level of education increases the probability a respondent will have a mobile. Housewives and people who are unemployed or retired are still less likely to own a mobile than workers. Singles and people living in a mixed family have a lower prob- ability of owning a mobile than respondents living in a family made up of a couple with children.

Table 2 summarizes the influence of spatial variables on computer and mobile phone ownership and Internet access. In the first stage of the diffusion of personal computers, all the spatial variables are important, while for the Internet only the spatial variables at a micro level are relevant, and for the mobile only the very micro and the very macro. On the whole, however, the spatial variable which is the strongest and which maintains its strength over the course of time is country, followed by macro region and then by city size. Therefore it appears that the larger a space is, the stronger its influence is on the possession of new media.

Table 2. Spatial variables' significance (+) at 95% in Europe in 1996 and 2009

	Computer		Internet		Mobile phone	
	1996	2009	1996	2009	1996	2009
House size	+	Np	+	Np	+	Np
City size	+	-	+	-	-	+
Macro region	+	+	-	+	-	+
Country	+	+	-	+	+	+

NB: The data for house size in 2009 were not collected.

In the second step of the analysis we conducted a series of logistic regressions with the aim of investigating whether, if the spatial variables were considered altogether, they would influence the computer and mobile phone ownership and/or Internet access once the structural variables have been controlled. This has now been completed for each individual country, in order to investigate whether the relations between the variables varied significantly between them. As shown in Table 3, some variables, such as city size, lose strength, while the macro regions maintain their influence. Among the structural variables, the strongest are activity and family typology, then education, followed by gender and age. Each country reacted in a specific way to the spatial variables. In 1996 the most sensitive countries were Germany and Spain, while the least sensitive was France. In 2009 the impact of spatial variables on the ownership of these three media was much more moderate.

France and Spain, for example, do not show any significant relationship between the ownership of new media and the spatial variables, while Germany shows only two significant relationships between computer ownership and Internet access and its macro regions. These countries also react in a specific way to the structural variables; for example, in 2009, Spain did not show any significant relationship between gender and new media ownership, while France did not show any significant relationship between age and new media ownership.

Table 3. Ownership of computer, Internet and mobile phone in the five European countries in 1996 and 2009: spatial and structure variables' significance (+) at 95%, and Hosmer-Lemeshow test significance per each model

	Italy 1996			France 1996			Germany 1996		
	Comp.	Inter.	Mob.	Comp.	Inter.	Mob.	Comp.	Inter.	Mob.
Macro Regions	+						+		
City size	+		+	+			+		
House size							+	+	+
Age				+		+	+		+
Gender				+			+		
Education	+			+			+	+	
Activity	+	+	+			+	+		+
Family typology	+	+	+	+			+		
Hosmer-Lemeshow test significance	0.43	n.s.	0.22	0.87	1.00	n.s.	0.35	n.s.	0.91
	Spain 1996			UK 1996					
	Comp.	Inter.	Mob.	Comp.	Inter.	Mob.			
Macro Regions	+		+			+			
City size	+	+	+						
House size	+		+	+		+			
Age	+	+		+					
Gender	+			+	+				
Education	+		+	+	+				
Activity	+					+			
Family typology	+	+		+		+			
Hosmer-Lemeshow test significance	0.65	n.s.	n.s.	0.06	0.08	0.42			
	Italy 2009			France 2009			Germany 2009		
	Comp.	Inter.	Mob.	Comp.	Inter.	Mob.	Comp.	Inter.	Mob.
Macro Regions	+	+					+	+	
City size		+							
House size									
Age	+	+	+				+	+	+
Gender	+	+		+	+		+	+	+
Education	+	+	+	+	+		+	+	+
Activity	+	+	+		+	+	+	+	+
Family typology	+	+	+	+	+		+	+	+
Hosmer-Lemeshow test significance	n.s.	n.s.	0.78	n.s.	0.12	0.26	n.s.	n.s.	0.40
	Spain 2009			UK 2009					
	Comp.	Inter.	Mob.	Comp.	Inter.	Mob.			
Macro Regions				+	+				
City size						+			
House size									
Age	+	+	+			+			
Gender				+		+			
Education	+	+	+		+				
Activity	+	+	+	+	+	+			
Family typology	+	+	+	+	+	+			
Hosmer-Lemeshow test significance	n.s.	n.s.	n.s.	n.s.	n.s.	0.18			

4 Final Discussion and Conclusion

These results tell us various things. First, that spatial variables are very important and have to be considered carefully when designing surveys concerning new media. Second, each area of information and communication technology has its own particular relationship with space and produces a specific communication space. Third, it seems that the larger the space is the higher is the probability that it will exert influence upon the possession of new media, even though the spatial variables do not increase in strength automatically as the dimensions increase. Media are spaces themselves, which bring different information and communication projects, procedures, practices and potentialities, and that shape in a particular way the space surrounding them. They in their turn are shaped by this space, which conveys social practices but also the infrastructures which are fundamental for the diffusion of ICT. Fourth, the relationship that each device has with space changes according to the specific moment of its diffusion For example, at the beginning of the diffusion of all new media, the dimension of the house was a relevant factor. The domestication and integration process of technologies inside the domestic space involves the space of the house. Therefore the more a technology is essential to the running of a house, the easier it is to find a solution to accommodate it in the domestic space.

Thirteen years later, the importance of macro regions became vital to understanding the ownership of new media. New media seem to be used to enlarge the physical space in which one lives only when this physical space is already large. Fifth, each country reacts in a specific way to spatial variables, showing that cultures have the strength to respond in a unique fashion to these spatial variables. Sixth, in the 2009 survey, the socio-demographic variables were no longer useful in explaining computer ownership or Internet access. This has important implications regarding the debate concerning the relationship between social exclusion and these technologies. In this debate there is a rhetoric which attributes the lack of access to these technologies to socio-economic factors. However, this research shows that other variables are involved in the lack of ownership of new media. Seventh, ICTs are not automatically connected to the urban dimension anymore, in the sense that this dimension no longer allows us to clearly discriminate in terms of who owns new media. This result confirms those obtained by Taipale in his research projects [29, 30]. The notion of codespaces as we redefined it and as it emerges from this research works well, with this one distinction: a crowded physical space does not automatically correspond to a digital intensity.

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