



Silver surfers from a European perspective: technology communication usage among European seniors

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Abstract

Filling a gap in our understanding of how senior citizens use information and communication technologies (ICTs), we identified several profiles of technology communication use among European seniors (aged 65+). These profiles include: *Digitally immersed communicators*, *Asynchronous communicators* and *Phone enjoyers*. We outline the importance of a broader distinction, one that surpasses the non-user and user dichotomy, and explores the singularities of the seniors who overcome the challenge of adopting and using ICT. We consider the *digital divide* concept as a starting point for the theoretical background that we reviewed in order to explain the process through which senior citizens accept and adopt this technology. Analysing data gathered within the Eurobarometer (Standard Eurobarometer 84 Autumn 2015—media use in the European Union. <https://dbk.gesis.org/dbksearch/sdesc2.asp?no=6642>, 2015), we applied K-Means Cluster analysis and discriminant analysis in order to identify three types of older Internet users. We run the analysis on a sample of 4404 respondents aged between 65 and 99 years. Our results help with increasing the adequacy of Digital Single Market policies for European seniors, as well as with more suitably targeting senior for social care and medical care programmes in the digital environment. Providing suggestions for further research, we argue for an in-depth classification of ICT users, based on characteristics such as gender, education, ethnicity or social class.

Keywords Digital divide · ICT · European comparative analysis · Seniors

Introduction

Our aim is to identify types of ICT users among European seniors, taking into account variables which measure relevant aspects for differentiating between various profiles of this demographic use of technologically mediated communication activities. We use cross-national survey data on specific technology usage for three types of senior ICT users.

Over the last two decades, the literature focusing on the digital divide associated with age among computer and Internet users grew significantly [see Mwim and Kritzinger (2016) for a literature review of papers published between 2000 and 2014 or Wagner et al. (2010) for a longitudinal analysis of articles published since 1990]. However, studies

covering cross-national comparative analysis of seniors' patterns of web usage are rather scarce (Nilsson 2007; Peacock and Künemund 2007; Quadrello et al. 2005). While this topic has been approached by scholars, who analysed how Internet usage varied with respect to age, gender, education, socio-economic status or country-aggregated data, we argue for the importance of more comparative analyses oriented towards the relationship between ageing and seniors' online behaviour. Considering that ageing is the most significant demographic phenomenon for the European population (Bloom and Luca 2016; Van de Kaa 1987), impacting population structure and social reality, we construct our argumentation around two dimensions.

Digital divide

Digital divide can be conceptualized as “the gap between those who have and do not have access to computers and the Internet” (Van Dijk 2006, p. 221). The study of digital divide has long been emphasizing the inequality encompassed within

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people's access to technology and digital devices. Nevertheless, placing the access issue within a broader context in order to address the impact of information and communication technology on social inequality brings about a better understanding of the digital divide phenomenon (DiMaggio et al. 2001).

Beyond Internet access, digital divide is also conceptualized in terms of “attitudes, access, skills and types of usage” (van Deursen and Van Dijk 2013, p. 509). The gap in access to the Internet and/or digital devices developed over time, and includes multiple disparities regarding skills on how to use the Internet and/or digital devices (van Deursen and Van Dijk 2011). Forms of digital inequalities multiply as we move from inequalities in access to disparities on the level of digital engagement, which differentiate between those who create digital content and those who only consume it (DiMaggio and Garip 2012).

The category of Internet users differs in terms of demographic characteristics from that of non-users (Cotten et al. 2014). People over 75 years of age use the Internet less frequently than younger age groups (Cotten 2017). In addition, digital exclusion occurs as a result of circumstances such as “financial constraints, lack of training and prior experience” (Barnard et al. 2013, p. 1716). However, older people are stereotypically described as facing financial difficulties and as being resistant to change, which has a considerable impact on technology development for and adoption by this age category (Cutler 2005).

One of the causes of a reduced rate of seniors adopting and using technology is the design of such devices (van Biljon et al. 2010; Holzinger et al. 2007), given the fact that it does not meet their specific needs. These particular needs usually derive from physical and cognitive difficulties that might generate refrain among seniors in regard to the use of information and communication technologies (Berkowsky et al. 2013).

Beyond the binary approach that distinguishes between Internet users and non-users, the access to technology encompasses more than Internet connection, or people's ability to use digital devices; it also requires audacity and comfort while using technology (Wyatt 2005). Consequently, the study of digital divide comprises the differences between Internet and other types of digital information sources in regard to access and usage, the inequality that exists between individuals who are provided with Internet access, as well as the way Internet access and usage condition individuals' opportunities.

Similar studies on seniors' technology usage

Previous research that has been carried out on the topic of digital divide and seniors' usage of technology identified factors that determined profiles of technology users among

older adults. Among the factors identified as influencing technology usage, there were: preference for a certain type of technology and frequency of use (Olson et al. 2011; Tsai et al. 2015), purposes for technology usage (Nimrod 2013), biographical experiences (Peacock and Künemund 2007) and also, socio-demographic factors (Fox 2006, 2008; Jensen et al. 2010). Combinations of non-digital practices and ICT use were identified among senior users by Quan-Haase et al. (2016).

Considering the heterogeneous character of the senior users' group, as emphasized in the studies cited above, it is important to investigate technology and Internet usage among seniors to a larger extent, beyond the dichotomous division between users and non-users (Olson et al. 2011). Although there are authors who stress the “clear division between users and non-users” (Nasi et al. 2012, p. 174), the digital divide phenomenon cannot be understood simply in terms of “haves and have-nots” (Wyatt 2005, p. 212).

Older Europeans tend to belong to the groups of “non-users” and “sporadic users” of Internet (Brandtæg et al. 2011; Neves 2015). Senior Internet users who are part of online communities can be grouped as “information swappers”, “ageing-oriented” and “socializers” (Nimrod 2013). The online activities that senior users perform target information, news, personal development, commercial transaction, leisure, social interaction and gaming (van Deursen and Van Dijk 2013). Senior mobile phone users were grouped as “explorers”, “basicians” and “minimalists” by Lee (2007), while smartphone senior users were described as being concerned with social interaction, hobbies and entertainment (Rosales and Fernández-Ardèvol 2016).

Our analysis sought to extend the level of knowledge regarding seniors' experience with technology and Internet communication. It is important to distinguish between several profiles of Internet usage and communication activity because older people form a heterogeneous category, and their lifestyles vary depending on numerous criteria, technology usage being one of the most important in this digital era.

Data and methods

Data

The data we use were collected for the Eurobarometer (2015) (Standard Eurobarometer 84), which included the 28 country members of the European Union. Respondents were 15 years and older, and they were residents in the respective country. The total number of respondents for the analysis was 27,822. At country level, the range of respondents was between 1036 (Denmark) and 300 (Northern Ireland). We selected only the cases that were 65 years old and over for our analysis. The number of respondents was 7538. As a

consequence of excluding cases coded “Inapplicable”, 4404 cases were processed for the analysis.

The data were collected using a multi-stage, random probability sampling. A number of sampling points were drawn with probability proportional to population size as well as population density with respect to each country. The stratification by individual unit and type of area was performed in order to systematically draw the sampling points from each of the administrative divisions. The comparison between the sample and the general population was made for the countries included in this study, and the data were weighted using marginal and intercellular weighting in order to make the results representative for the population (Eurobarometer 2015).

Variables

The variables that we selected in order to run the analysis measure on seniors’ usage patterns for communication activities, paid Internet services and Internet use frequency and were included due to their potential for revealing the communication devices that European seniors prefer. Therefore, ICT devices are an important aspect that shape users’ profiles.

In order to measure their communication activity, participants were asked about their frequency for using mobile phones, landline phones and the Internet. This question was structured in seven items. We reordered the response scale in order to have higher scores for higher frequency of usage, so the scale ranged from 1 (*never*) to 7 (*several times a day*): How often do you do any of the following? Make or receive phone calls over a landline phone; make or receive phone calls over a mobile phone; send or receive SMS; use an instant messaging service on the Internet; make phone calls via Internet applications, including video calls; send e-mails; and post content on online social media.

Another question captured the use of paid Internet services. There were six items corresponding to this question with variables being “dummy coded” in the dataset (0 = *no*, 1 = *yes*): Which of the following paid services that you can access via the Internet, have you used? a paid service for accessing music; a paid service for accessing movies or documentaries; a paid service for accessing digital books or newspapers; a paid service for watching sports events; a paid service for making phone calls over the Internet; and a cloud service for storing content from your computer.

We also considered the question for the frequency of Internet usage depending on the place of access as an important one to be included in our analysis. The battery of questions contained three places of Internet access: “home”, “work place” and “elsewhere”. We reordered the response scale so the value 1 corresponds to “never” and the value 6 corresponds to “every day” or “almost every day”.

These questions are relevant for our analysis because of their potential for displaying different patterns of Internet usage among European seniors, based on the frequency of usage, the type of device used by the respondents, the type of services and the place of Internet access.

Analytical technique

We conducted our analysis using the “K-Means Cluster Method”, from IBM SPSS Statistics 22. Our aim was to classify the participants by analysing their responses and identifying relevant differences regarding their ICT use. The analysis we conduct is exploratory.

K-Means Cluster analysis identifies structures within a dataset by grouping together homogenous cases, and it operates within a number of clusters set by the analyst. We can choose between iterating and classifying the cases, or only classifying them. Distances between cluster centres are determined using Euclidean distance (IBM Knowledge Center 2017).

We chose to create 3 clusters of older ICT users, so we can better observe the specificities of users’ profiles regarding their communication activity and Internet usage. We tested versions of cluster analysis with four and five clusters, but the analysis with three clusters was superior in terms of statistical stability and theoretical relevance, given the distribution of the cases and the user profiles that the analysis revealed. We chose to iterate and classify our cases, and we set the maximum iterations to 10. We chose the single imputation—expectation maximization (EM) as a method for replacing the missing values.

In order to avoid the limitations inherently associated with K-Means Cluster analysis, we also conducted “discriminant analysis”. This analysis is used to predict group membership, and we used it alongside K-Means Cluster analysis in order to emphasize the statistical stability of our classification. Again, we used single imputation—EM to replace missing values. In addition, we used within-group covariance matrix and computed from group sizes.

Results

We used in our analysis variables that measure the extent to which European seniors are involved in “communication activity”, in using “paid Internet services” and the frequency of their “Internet usage”. The percentages show the most frequent use for “communication activity” and for “Internet use frequency” (“several times a day” and “every day or almost every day” answers, respectively). The percentages for “paid Internet services” correspond to the participants who mentioned they pay for Internet services. This information is available in Table 1.

Table 1 Percentage of people answering positive to the items indicating ICT use, by groups of variables. *Source:* Eurobarometer 84.2 (October 2015), weighted data, $N=4404$

Euro 28	65–74	75+	Entire population
Communication activity (only <i>several times a day</i> answers)			
Landline phone calls	28.5	34.1	30.0
Mobile phone calls	52.5	37.2	48.5
Send or receive SMS	22.5	13.9	20.2
Instant messaging	9.7	4.5	8.3
Internet phone calls	3.0	1.5	2.6
Send e-mails	19.8	11.5	17.7
Online social media posting	4.3	2.8	3.9
Paid Internet services used (only <i>mentioned</i> answers)			
Music	4.6	1.6	3.8
Movies/documentaries	5.0	2.5	4.3
Digital books/newspapers	6.9	4.7	6.3
Sport events	4.6	2.4	4.0
Phone calls	3.4	1.9	3.0
Cloud content storing	4.5	2.0	3.9
Internet use frequency (only <i>every day or almost every day</i> answers)			
At home	56.8	38.7	52.3
At place of work	8.0	2.8	6.7
Somewhere else	4.9	1.9	4.1

The data for communication activities reveal the usage patterns for the use of ICT among respondents. People who

are 75 years of age and over tend to use mobile phones and Internet technology less frequently than people who are 65–74 years old. The 75-year-old seniors tend to prefer “landline phone calls” and “mobile phone calls” as a means of communication, and they are the least interested in paying for Internet services. The frequency of Internet use was higher for people 65–74 years of age, when compared to the 75+ age category.

The profiles for senior Internet users that we identified using cluster analysis are as follows: *Digitally immersed communicators*, *Asynchronous communicators* and *Phone enjoyers*. Table 2 contains the data for each type of seniors’ ICT usage. The variables measuring “communication activity” are the most relevant in differentiating between seniors’ usage of ICT; hence, older people’s communication preferences significantly shape the typology of information and communication technology users.

Digitally immersed communicators are ICT users who tend to score high on every item of the variables that we analysed, indicating a pattern of frequent and diverse use. They are familiar with devices such as landline phones and mobile phones, as well as with devices that are connected to the Internet as a means to communicate and spend their time. They also pay for certain Internet services, indicating that the digital arena has become a familiar space for transactions. Their frequency of Internet use is higher, irrespective of the place of access, when compared to the other user profiles.

Asynchronous communicators are familiar with Internet and communication technology, but they do not use it as

Table 2 Mean scores within each cluster. *Source:* Eurobarometer 84.2 (October 2015), weighted data, $N=4404$

Euro 28	Digitally immersed communicators	Asynchronous Communicators	Phone enjoyers
Communication activity			
Landline phone calls	4.05	5.24	4.27
Mobile phone calls	6.67	5.75	5.10
Send or receive SMS	5.66	4.42	2.18
Instant messaging	4.70	1.46	1.14
Internet phone calls	3.10	1.56	1.14
Send e-mails	5.74	4.70	1.17
Online social media posting	3.48	1.40	1.06
Paid Internet services used			
Music	0.11	0.03	0.00
Movies/documentaries	0.09	0.04	0.02
Digital books/newspapers	0.15	0.07	0.01
Sport events	0.08	0.04	0.02
Phone calls	0.08	0.02	0.01
Cloud content storing	0.11	0.04	0.00
Internet use frequency			
At home	5.73	5.61	2.29
At place of work	1.99	1.45	1.04
Somewhere else	2.20	1.40	1.04

frequently as *Digitally immersed communicators*. The major differences between these two types of users correspond to “communication activity”. *Asynchronous communicators* rely heavily on landline phones, mobile phones and e-mails as means of communications. Their preference for communication activities that have an asynchronous character is noticeable in regard to “instant messaging” (*Digitally immersed communicators* score 5.81 on this item, while *Asynchronous communicators* score 1.25), “Internet phone calls” (3.10 for *Digitally immersed communicators* and 1.66 for *Asynchronous communicators*), “online social media posting” (3.25 for *Digitally immersed communicators* and 1.79 for *Asynchronous communicators*). *Asynchronous communicators* rarely pay for Internet services; their higher score (0.08) marks their preference for “digital books” and “newspapers”. The frequency of Internet usage is average for this category of users, their scores placing them between *Digitally immersed communicators* and *Phone enjoyers*.

Phone enjoyers are characterized by the lowest scores in regard to the “communication activity”, “paid Internet services” and “Internet use frequency”. They prefer to reach other people through landline phone calls and mobile phone calls and do not explore the digital spaces and services too often. *Phone enjoyers* generally do not pay for Internet services and their frequency for Internet use is relatively low. Similar to seniors in the other profiles, when they use the Internet, they prefer to access it from home, compared to other places. However, *Digitally immersed communicators* and *Asynchronous communicators* access the Internet from home twice as much as *Phone enjoyers* (5.70 for *Digitally immersed communicators* and 5.65 for *Asynchronous communicators*, compared to 2.18 for *Phone enjoyers*).

In the Northern regions, the type of users that prevails is *Asynchronous communicators*. The situation is similar in Western European countries, but the category of *Digitally immersed communicators* is higher in this area, unlike Northern countries. In the Southern and in Eastern Europe, the dominant profile is *Phone enjoyers* (see Table 3).

With regard to the *Digitally immersed communicators* profile, 85% of seniors are between 65 and 74 years of age. Older adults in this category generally have a high education level (54% have more than 20 years of education). 79% of *Asynchronous communicators* are 65–74 years old. *Asynchronous communicators*’ education level is rather high, with 53% of them having over 20 years of full-time education. With regard to the *Phone enjoyers* profile, 65% are 65–74 years old. Their education level is lower compared to the other two profiles (40% have 16–19 years of education). For more information on the demographic variables, see Table 4.

Aside from the cross-national perspective on seniors’ ICT usage that was provided by the profiles, we attempted to present a concise contextualization of the data at the national

level. We placed the variables that we used for our cluster analysis in the table below, grouping the countries in our analysis by European Union region (Table 5).

The discriminant analysis (Tables 6, 7) that we conducted showed that over 95% of the cases were correctly classified. The highest correlation coefficient between the independent variables is 0.344 (between “communication activity—send or receive SMS” and “communication activity—mobile phone calls”), which is a rather weak correlation. Therefore, there are no signs of multi-collinearity within the data. Overall, discriminant analysis shows that the senior user profiles that we previously identified using K-Means Cluster analysis are statistically stable and the findings are in line with each other.

Discussion

We identified three profiles of ICT users among European seniors, using representative data for this population. The older Europeans who use the information and communication technologies are different in terms of their usage, so we grouped them as *Digitally immersed communicators*, *Asynchronous communicators* and *Phone enjoyers*. The K-Means Cluster analysis revealed some specificities for each of the profiles identified, as follows.

Digitally immersed communicators use various devices and technologies in order to communicate, either via landline phone, mobile phone, Internet calls, instant messages, social media postings, just to name a few of their preferred means of communication. They willingly pay for Internet services that provide entertainment, content storing or phone calls. This particular group also uses the Internet frequently, from either home, the work place or elsewhere. Their distinctive characteristic is, according to their reports, the frequent use of all the means and devices of Internet communication they were questioned about.

Asynchronous communicators are ICT users whose frequency of use is lower than *Digitally immersed communicators*. They tend to use more of a “traditional” means of communication, such as landline phones, mobile phones or e-mails. They are rarely involved in social media posting, although their Internet usage is also related to sending and receiving instant messages, as well as making Internet phone calls. *Asynchronous communicators* do not prefer “paid Internet services”; therefore, their usage of such services is rather reduced. They are remarkable as a user profile for their medium level of acceptance and usage of the Internet for communication activity.

Phone enjoyers form the category of older adults who accept the Internet and the devices related to it, but they do not use them frequently. Moreover, they are selective with regard to communication activity and paid Internet services.

Table 3 Cluster sizes by EU region (%). *Source:* Eurobarometer 84.2 (October 2015), weighted data, $N=4404$

Euro 28	Digitally immersed communicators	Asynchronous Communicators	Phone enjoyers
Eastern Europe			
Bulgaria	15.8	10.5	73.7
Czech Republic	4.5	49.3	46.3
Hungary	16.9	29.2	53.8
Poland	20.3	23.4	56.3
Romania	12.5	4.2	83.3
Slovakia	14.3	22.1	63.6
Northern Europe			
Denmark	23.0	57.8	19.1
Estonia	3.5	35.7	60.8
Finland	23.7	55.3	20.9
Great Britain	13.8	43.4	42.9
Ireland	15.8	44.2	40.0
Latvia	14.5	38.5	47.0
Lithuania	4.5	25.6	69.9
Northern Ireland (GB)	24.1	43.1	32.8
Sweden	29.2	60.3	10.5
Southern Europe			
Croatia	19.2	21.2	59.6
Cyprus	7.1	28.6	64.3
Greece	1.9	15.1	83.0
Italy	33.8	20.6	45.6
Malta	21.3	32.5	46.3
Portugal	13.8	15.0	71.3
Slovenia	6.4	33.6	60.0
Spain	34.6	6.5	58.9
Western Europe			
Austria	20.7	48.3	31.0
Belgium	19.4	50.6	30.0
France	18.9	32.8	48.4
Germany (West)	14.5	48.5	37.0
Germany (East)	25.3	34.7	40.0
Luxembourg	37.3	37.3	25.3
The Netherlands	26.1	53.7	20.2

Phone enjoyers are still resistant to social media usage and to Internet services that require payment. This resistance can be defined as their unique characteristic in relation to the other two profiles.

At the European level, the three profiles that we identified vary from one region to another, so that *Digitally immersed communicators* and *Asynchronous communicators* are predominant in the Northern and central areas, while *Phone enjoyers* prevail in Southern and Eastern countries. The geographical distribution of the user profiles might indicate the existence of certain variables related to the development level of the regions, such as economic, digital or cultural factors. In addition, this distribution reflects the differences between European

countries in terms of household Internet access. Most of the countries having over 90% of household Internet access are located in Northern and Western Europe. Countries in Eastern and Southern regions of Europe have the lowest percentages of household Internet access—67% Bulgaria, 71% Greece (Statista - The Statistics Portal 2019).

The younger age category in our analysis tends to be more involved with Internet and technology. The category of people 75 years of age and over is rarely engaged in online activities compared to those who are 65–74 years old. A possible explanation would be the exposure level to technology and Internet during earlier stages of life (Harada et al. 2013), or the socialization process and the biographical experiences (Peacock and Künemund 2007).

Table 4 Column percentages of socio-demographic variables (%). Source: Eurobarometer 84.2 (October 2015), weighted data, $N=4404$

Euro 28	Digitally immersed communicators	Asynchronous communicators	Phone enjoyers
Age			
65–74	84.6	79.3	65.4
75+	15.4	20.7	34.6
Occupation			
Retired	84.8	89.5	87.6
Homemakers	1.9	1.2	5.1
Unemployed	0.1	0.1	0.1
Manual workers	1.6	1.6	4.2
Self-employed	5.7	3.4	1.2
White collar	2.0	1.3	1.0
Manager	3.9	2.9	0.8
Educational level			
Up to 15 years	13.8	11.8	36.0
16–19 years	31.7	34.3	40.4
+20 years	53.9	53.1	22.3
No full-time education	0.6	0.8	1.4
Gender			
Men	55.5	53.0	43.4
Women	44.5	47.0	56.6

Our study of older adults and their ICT usage expands on and brings critical nuance to the long-established division of seniors in two categories: the category of technology users and the category of non-users. Our approach is consistent with previous research, such as that conducted by Olson et al. (2011), Wyatt (2005) and Brandtzæg et al. (2011), who suggested the widening classification of senior technology users as a productive study direction. The analysis that we conducted deepens the perspective set about by Brandtzæg et al. (2011), Neves (2015) and Nimrod (2013) and the typologies of senior mobile phone users documented by Lee (2007) and Rosales and Fernández-Ardèvol (2016).

The distinction that we make between the three types of senior ICT users is relevant in a modern society characterized by the digital divide and numerous barriers to acceptance and usage of technology by seniors. Our contribution consists of identifying profiles for senior ICT users, while emphasizing the elements that are specific to each profile and that differentiate between them. Although previous research documented some Internet user types and placed them in a digital divide context, our analysis classifies seniors' online experience and Internet usage, and points out seniors' interaction with various elements of ICT.

Nimrod's typology (2013) accounts for senior users of websites and forums located in English-speaking, Western countries and Lee (2007) classified USA seniors based on mobile phone usage behaviour. Our research improves on existing typologies by documenting seniors' usage of multiple technologies and emphasizing seniors' specific interests

and needs in the virtual environment (types of devices, platforms and services they use). We also report how seniors' ICT preferences aggregate across national spaces and cultural areas, accommodating diverse categories among the wide public of senior ICT users, which facilitates the connection between this typology and EU public policies.

Large cohorts of seniors witness the digitalization of daily life, and they are subject to policies aiming to increase their engagement with the digital environment. *Digitally immersed communicators* are largely engaged in ITC use, while *Asynchronous communicators* are familiar with these technologies. The major problem concerning the *Phone enjoyers'* can be correlated with their low rates of ICT usage, but also to the lack of Internet access. (The Eastern and Southern parts of Europe are characterized by low rates of household Internet access and high rates of *Phone enjoyers*.)

ICT differs in many respects from previous technologies because of their artificial intelligence characteristics/techniques. Therefore, as human–computer interaction evolves, the virtual environment provokes changes in matters such as politics, culture and economy. Due to the notion that *Digitally immersed communicators* are well acquainted with ICT, this group achieves a greater level of connectedness and are generally more informed, allowing for the ability to find virtual opportunities that perhaps would have been missed otherwise, as well as allowing for maintenance of social contacts. They can be more involved in political matters, have more economic opportunities and

Table 5 Descriptive data for the variables used in analysis*, by EU region (%). *Source:* Eurobarometer 84.2 (October 2015). All respondents of age 65+

Euro 28	Communication activity							Paid Internet services						Internet use frequency		
	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16
Eastern Europe																
BG	34.6	32.9	72.2	94.8	95.3	93.9	95.8	2.0	2.0	0.0	2.0	2.0	0.0	78.4	96.4	94.4
CZ	79.1	7.3	29.9	97.6	90.8	71.8	96.0	.0	3.7	0.0	2.5	6.2	0.0	63.3	98.6	95.9
HU	34.2	25.6	68.4	90.0	90.0	80.4	88.6	3.4	3.4	5.7	3.4	0.0	3.4	70.7	94.2	93.9
PL	42.7	24.4	54.6	87.9	89.0	84.4	90.7	6.1	4.9	3.7	0.0	2.4	1.2	62.4	92.1	92.0
RO	50.2	31.2	80.9	92.6	97.8	95.7	97.0	0.0	1.0	1.0	1.0	0.0	0.0	88.5	98.9	99.5
SK	40.6	21.0	61.2	89.4	87.5	83.6	92.5	0.0	1.0	2.9	2.9	2.9	1.9	72.7	96.2	96.2
Northern Europe																
DK	36.0	7.5	22.6	72.0	75.4	24.6	54.2	4.9	6.7	11.9	3.1	4.0	5.8	7.3	91.8	75.4
EE	39.6	12.0	62.3	95.4	86.3	77.5	93.7	1.6	1.1	1.6	0.0	.5	0.5	47.2	89.0	92.2
FI	74.9	1.7	13.1	76.8	77.7	39.9	78.0	2.6	8.9	4.1	10.7	1.5	2.2	22.4	93.3	87.2
GB-GBN	10.8	24.8	51.4	84.6	85.6	53.1	88.6	5.9	2.5	9.7	5.9	2.1	6.3	40.2	95.7	90.1
IE	12.3	15.0	38.8	81.9	82.0	56.9	88.2	4.0	4.7	10.0	4.7	2.7	5.3	44.4	91.3	90.8
LV	53.3	4.4	28.5	85.0	81.6	70.2	91.2	0.0	1.6	1.6	2.4	2.4	1.6	55.0	90.4	91.7
LT	54.0	9.8	58.9	96.1	84.7	90.1	96.4	0.6	1.1	0.0	0.0	0.6	0.0	72.3	96.1	98.3
GB-NIR	4.6	29.2	49.5	83.2	79.6	57.4	84.3	1.5	10.8	6.2	7.7	6.2	4.6	38.5	96.9	91.8
SE	19.6	4.0	13.7	66.6	67.2	16.8	68.1	13.2	9.3	18.6	8.9	5.5	14.1	9.1	81.3	65.1
Southern Europe																
HR	17.1	28.6	60.0	89.3	89.3	82.9	95.7	1.6	3.1	1.6	4.7	0.0	0.0	64.9	97.0	91.4
CY	21.2	11.7	67.6	88.8	87.1	90.0	92.0	2.2	6.7	0.0	6.7	6.7	0.0	64.0	94.1	98.1
GR	8.8	27.9	77.8	96.0	93.6	91.6	95.5	1.1	1.1	1.1	1.1	3.4	1.1	75.0	95.4	97.3
IT	27.8	20.9	60.4	86.7	92.0	81.4	91.0	2.2	4.4	1.1	5.5	1.1	3.3	69.6	95.6	95.1
MT	4.2	18.7	50.3	82.8	86.6	72.0	89.6	2.2	7.6	7.6	5.4	6.5	1.1	45.0	94.6	91.9
PT	20.5	22.6	71.1	91.4	96.7	90.5	92.2	4.0	4.0	3.0	5.0	1.0	1.0	80.5	97.5	95.6
SI	14.4	13.4	60.9	92.6	89.6	79.3	95.0	1.1	2.2	4.4	2.2	0.5	0.5	58.5	98.5	94.5
ES	13.1	23.7	86.0	78.6	90.4	80.4	91.1	0.8	2.4	5.6	1.6	2.4	1.6	74.5	98.8	93.9
Western Europe																
AT	27.8	22.0	55.2	83.9	82.4	71.6	87.4	9.2	6.9	11.5	4.6	6.9	5.7	37.9	97.4	91.2
BE	7.9	15.8	39.5	85.0	82.4	51.0	85.5	2.7	3.2	2.7	2.7	1.8	3.2	37.3	96.0	92.5
FR	11.4	24.7	55.7	79.7	90.8	62.0	92.2	1.1	1.6	1.1	2.7	3.7	2.7	41.7	98.5	91.7
DE-E	5.3	29.5	61.1	81.1	87.9	60.0	93.7	1.0	2.0	2.0	1.0	3.0	1.0	43.9	95.7	88.1
DE-W	3.7	20.6	53.0	80.3	89.5	52.7	94.3	1.6	2.6	5.2	2.1	1.0	1.0	34.8	94.0	91.8
LU	2.5	13.2	30.6	74.2	75.6	49.6	83.9	2.3	3.4	6.8	0.0	5.7	1.1	27.8	96.9	77.7
NL	2.5	10.1	41.0	70.6	75.5	18.3	76.9	6.9	4.2	8.8	4.2	6.1	6.9	9.9	85.1	76.8

*Communication activity (only “never” answers): V1—landline phone calls, V2—mobile phone calls, V3—send or receive SMS, V4—instant messaging, V5—Internet phone calls, V6—send e-mails, V7—online social media posting; paid Internet services used (only “mentioned” answers): V8—music, V9—movies/documentaries, V10—Digital books/newspapers, V11—sport events, V12—phone calls, V13—cloud content storing; Internet use frequency (only “never” answers): V14—at home, V15—at place of work, V16—somewhere else

develop cultural beliefs influenced by social media and the digital environment overall. *Asynchronous communicators* are aware of the digital realities and are influenced by them online and off-line, but to a lower extent than *Digitally immersed communicators*. *Phone enjoyers* are poorly connected to the digital environment, as their technological interests revolve around landlines and mobile

phones; thus, they engage less frequently in other ICT use. Human–computer interaction is limited in their case. They are not familiar with the new possibilities of more advanced ICT usage. This may cause them to miss out on opportunities because of their disconnectedness from a space where authorities develop policies they could benefit from.

Table 6 Hit ratio for cases selected in discriminant analysis. *Source:* Eurobarometer 84.2 (October 2015), weighted data, $N=4404$

Actual group	No. of cases	Predicted group membership		
		Cluster 1	Cluster 2	Cluster 3
Cluster 1	983	851 (86.6%)	3 (0.3%)	129 (13.1%)
Cluster 2	1831	3 (0.2%)	1767 (96.5%)	61 (3.3%)
Cluster 3	1590	36 (2.3%)	35 (2.2%)	1519 (95.5%)

Percentage of “grouped” cases correctly classified: 93.9%. Numbers in parentheses indicate the row percentages

Table 7 Hit ratio for cross-validation of discriminant analysis. *Source:* Eurobarometer 84.2 (October 2015), weighted data, $N=4404$

Actual group	No. of cases	Predicted group membership		
		Cluster 1	Cluster 2	Cluster 3
Cluster 1	983	848 (86.3%)	3 (0.3%)	132 (13.4%)
Cluster 2	1831	4 (0.2%)	1766 (96.5%)	61 (3.3%)
Cluster 3	1590	37 (2.3%)	37 (2.3%)	1516 (95.3%)

Percentage of “grouped” cases correctly classified: 93.8%. Numbers in parentheses indicate the row percentages

Implications

The diversity of ICT senior users in the European Union (EU) helps us to gain a better understanding of the digital divide by employing the perspective of senior user profiles. Acknowledging the diversity of senior users through a typology that transcends national boundaries may increase the adequacy of Digital Single Market policies for seniors. The digital environment can also be predatory, and senior users are a vulnerable category that could be better protected by policies targeting them specifically. As an implication for future research, subsequent studies may employ the perspective of senior user profiles in order to investigate seniors’ need for protection of their personal information in the digital environment and how online vulnerabilities differ based on seniors’ online habits.

Another set of implications of the three types of senior ICT users regard social and care programmes. Based on the communication activities they prefer, seniors use specific ICTs that help them to keep in touch with family members and friends and therefore to fight social exclusion. Care facilities could organize programmes in order to help seniors with developing digital skills depending on their preferences for digital activities. Furthermore, online medical care and medical services tailored to the three specific categories of senior users would provide them with the medical support they need, irrespective of the technology they use to access it. The personalization

of such programmes, according to user’s characteristics, would make the digital arena more accessible to seniors.

Limitations

The profiles offer a wider perspective on senior users of ICT in the EU at the expense of eluding certain nuances at the national/regional level. The variability that exists within European countries is not captured as precisely by clusters as it is by employing indicators of ICT use. Nonetheless, users’ profiles are superior in emphasizing human profiles of senior users from the EU. Another limit of this study is that we did not prioritize users’ classification on gender, education, ethnicity or social class, because our focus was on the age classification of respondents. Subsequent studies may extend the classification of senior users’ as to include in-depth socio-demographic characteristics.

The attrition of the number of respondents is also a limit of our analysis. As a consequence of selecting only respondents aged 65 and over, the total number of respondents was significantly reduced. Then, we had to exclude those who declared they did not use the Internet. We run our analyses on a sample of 4404 cases that was representative for the EU countries; therefore, our results are illustrative for the ageing population.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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