

# The impact of ‘technology generations’ on older adults’ media use: Review of previous empirical research and a seven-country comparison

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## Abstract

**Background:** In our information society, media use plays an important role. However, knowledge is lacking about whether specific birth cohorts show preferences for specific traditional or new media and whether technology generations can be identified across different countries.

**Objective:** A cross-cultural research project was carried out with the aim of providing empirical evidence for the concept of ‘technology generations’ formulated by Sackmann & Weymann (1994; 2013) in relation to media use by older adults. The research questions focus on empirical evidence for the existence of technology generations related to media use and preferences.

**Methods:** We tested differences in media use and media preferences (traditional versus new media) in Austria, Canada, Denmark, Israel, the Netherlands, Romania and Spain, using commensurate samples consisting of Internet users aged 60 years and older at the time we started collecting data in 2016 (N=10527). We selected three technology generations: the ‘mechanical generation’ (age group of 78 and above), the ‘household revolution generation’ (age group of 68-77), and the ‘technology spread generation’ (age group of 60-67), and analyzed the differences in media use and preferences between these technology generations and across the seven countries.

**Results:** Our cross-cultural data reveal differences between the technology generations, especially in terms of media use, but not in technology media preference (time spent using different media). We also found the effect of country of origin to be stronger than the effect of generation in explaining older adults’ preferences for traditional vs new media.

**Conclusions:** The results point to the need for a more nuanced view of the concept of ‘technology generation’, i.e., one taking into account contextual aspects, such as country of origin, gender, level of education, working status and the interaction effect between country of origin and ‘technology generation’.

**Keywords:** Technology generation, age, older adults, media use, digital media, technology acceptance, media replacement

## INTRODUCTION

### Background

In the digitizing, ageing societies of the West, the number of older adults making use of digital media is on the rise. At the same time, these societies are also finding themselves confronted with the specter of so-called digital divides, of which at least three have been distinguished. The first is between those with, and those without, access to digital media; a second digital divide is between those with the skills and those lacking the skills to make use of digital media (Attewell, 2001; Hargittai, 2001); and a third digital divide relates to the “gaps in individuals’ capacity to translate their internet access and use into favorable offline outcomes” (Van Deursen & Helsper, 2015, p. 30). Older adults are amongst those that may be affected by these digital divides, something we

know is a global phenomenon (Norris, 2001). This is due to the fact that older users are often “lag-gards” (Rogers, 2003) when it comes to adopting new (technological) products. Their lack of experience, more than their age, is an important factor that plays a role in this regard (Hill et al. 2011; Loos, 2011; Loos & Romano Bergstrom, 2014).

In many countries, statistics such as those published by Pew Research Center (PEW 2017) in the USA show that in 2017, “roughly two-thirds of those ages 65 and older go online and a record share now own smartphones – although many seniors remain relatively divorced from digital life”. Similarly, EU statistics show that 51% of adults aged 55 and older used the internet at least once a week in 2017 (Standard Eurobarometer, 2017, p. 16). Such statistics provide insight

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Table 1. The impact of 'technology generations' on older adults' media use

Technology generation	Cohort
Traditional	1900-1945
Intermediate modern	1946-1965
Technological modern	1966-1985
Post-technological	1986-1999

Source: Sackmann & Weymann (2013, p. 493)

into the percentage of those in these age groups with access to the internet, but say nothing about the correlation between the percentage of older adults who have internet access and the use by this age group of both digital and traditional media, such as printed versions of newspapers, radio and television. Nor do we know whether specific birth cohorts (more information will follow below) show preferences for specific traditional and new media or whether technology generations can be identified across different countries. In this paper we therefore use the concept of technology generations as developed by Sackmann & Weymann (2013, p. 493), who defined these as "groups of birth cohorts whose conjunctive experience with technology is differentiated by social change" to gain more insight into older adults' media use and their preferences.

## Technology generations

To what extent can older adults learn to really master new media with which they have not grown up? To answer this question, Van de Goor & Becker (2001) point out how important the formative period in life is:

In most of the publications about the formative period, the apex of that period is situated at about the age of seventeen and its end at about the age of twenty-five. Breitsamer (1976) has tested the hypothesis of the apex at the age of seventeen. The hypothesis was confirmed (conclusions restricted in time and space). To set the limit at the age of twenty-five is based on the idea that young adults at about that age acquire social independence. They have finished their education, have an income of their own and have set up their own household. The age limit of twenty-five is still primarily a component of the standard life course. Empirical testing is restricted to life courses that include marriage and a first child.

Table 2. The impact of 'technology generations' on older adults' media use

Technology generation	Cohort
Traditional	1900-1945
Intermediate modern	1946-1965
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The end of the formative period is relatively late if the level of education is relatively high (conclusions restricted in time and space). (p. 136)

A birth cohort – a cohort whose members have all been born within a certain span of time - will experience certain life events in the same way. Obviously, the introduction of a new technology counts as such a life event. Huysmans et al. (2004) argue that "successive cohorts grow up, each with their own specific constellation of available media, media competency and media preferences. These early experiences with media could later lead to shared behavioral patterns." (p. 20) [original in Dutch, translated by the authors of this paper]

Similarly, Van der Goot (2009, p. 255) argues: "(...) generations may very well develop specific patterns of media use when young and remain loyal to these patterns throughout the rest of their lives (Hofmann & Schwender, 200; Mares & Woodard, 2006)", (p. 255) [original in Dutch, translated by the authors of this paper]. Yet even though we belong to a specific cohort, depending on our stage of life, we might still be interested in using a particular medium (see for example Mante-Meijer, & Loos, 2008; Loos & Mante-Meijer, 2009, on the differences and similarities in the use of old and new media by different Dutch age groups looking for health information). We are never too old to learn new skills, such as how to use the new media (Loos, 2010, 2012; Van de Goor & Becker, 2001, p. 137). The question is whether there is empirical evidence in support of the notion that not having experienced the introduction of a new technology during the formative years impacts later media use to a certain extent. Sackmann & Winkler (2013, pp. 493-494) refer to 'technology generations' to explain this phenomenon.

Building on theories of generation (Mannheim, 1997; Ryder, 1965; Becker, 1991) and technology adaptation in everyday life 5-7, the concept of 'technology generations' was developed by German sociologists in the early 1990s (Sackmann & Weymann, 1994; Sackmann, 2013; Weymann & Sackmann, 1993; Sackmann & Winkler, 2013, p. 493) who defined a technology generation as "groups of birth cohorts whose conjunctive experience with technology is differentiated by social change". As Sackmann & Winkler (2013, p. 493) state: "Fast technological change, especially a change of basic technology, enlarges inter-cohort differences and raises the likelihood of a conscious perception and description of differences as generational difference. By their contemporary technological actions, people reproduce or dissolve technology generations technological practice=doing and undoing generation). The likelihood of the adoption of an innovative technological practice in later adult life ('undoing generation') is higher if the expected re-

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**Table 1.** Empirical evidence for the existence of ‘technology generations’ characterized by household appliance and Internet use, 2004 and 2010 (Fozard & Wahl, 2012).

	Technology spread	Household revolution	Mechanical	Technological
<b>Country<sup>(a)</sup> Total</b>	2,227 (30.2%)	2,227 (30.2%)	2,227 (30.2%)	1,227
Austria	964 (32.2%)	964 (32.2%)	41 (2.1%)	1,000
Canada	1,000 (20.0%)	1,000 (20.0%)	800 (10.0%)	200
Denmark	2,124 (21.0%)	2,124 (21.0%)	45 (1.2%)	2,079
France	2,012 (21.0%)	2,012 (21.0%)	40 (1.0%)	1,972
Germany (East)	420 (12.2%)	420 (12.2%)	20 (0.6%)	400
Germany (West)	2,012 (21.0%)	2,012 (21.0%)	40 (1.0%)	1,972
Spain	1,000 (20.0%)	1,000 (20.0%)	10 (1.0%)	990
<b>Gender<sup>(b)</sup></b>				
Women	2,227 (30.2%)	2,227 (30.2%)	2,227 (30.2%)	1,227
Men	2,227 (30.2%)	2,227 (30.2%)	2,227 (30.2%)	1,227
<b>Education<sup>(c)</sup></b>				
up to lower secondary	420 (12.2%)	420 (12.2%)	42 (1.0%)	378
upper secondary	2,012 (21.0%)	2,012 (21.0%)	20 (0.5%)	1,992
higher education	2,124 (21.0%)	2,124 (21.0%)	204 (9.6%)	1,920
Full education	1,000 (20.0%)	1,000 (20.0%)	100 (10.0%)	900
<b>Income</b>				
lower income group	420 (12.2%)	420 (12.2%)	12 (0.3%)	408
middle income group	1,000 (20.0%)	1,000 (20.0%)	100 (10.0%)	900
higher income group	2,124 (21.0%)	2,124 (21.0%)	80 (3.8%)	2,044
<b>Retirement status<sup>(d)</sup></b>				
Retired	2,227 (30.2%)	2,227 (30.2%)	227 (10.2%)	2,000
Non-retired	2,227 (30.2%)	2,227 (30.2%)	20 (0.9%)	2,207

<sup>(a)</sup> n = 21,721, 21.

<sup>(b)</sup> *maintaining years of active life increase (for instance, by postponing retirement)."*

They add that the “concept of technology generations encompasses technologically related cohort effects (Fozard & Wahl, 2012) - long lasting differences between birth cohorts in a given society- by referring to cohort differentiation due to changes in the social and cultural environment. It adds a generational perspective in *sensu* Mannheim (1979) by viewing basic technology changes as discontinuous breaks in technological evolution. Changes in basic technology causing generational differentiation usually occur when a new technology reaches a 20% threshold in households in the relevant formative years (ca. 15-25 years) of birth cohorts (Ryder, 1965; Rogers, 2003).”

The original study on technology generations based on qualitative interviews, group discussion, surveys, and secondary data and conducted in western and eastern Germany in the early 1990s by Sackmann & Weymann (1994) provided

empirical evidence for the existence of the following ‘technology generations’ in relation to the use of household appliances (Table 1).

An ICT survey on the private use of information and communication technologies conducted by Sackmann & Winkler (2013) in 2004 and 2010 based on data from the Statistical Bureau of Germany not only found empirical evidence for the same four technology generations, but identified a fifth one as well, characterized by the use of the Internet (Table 2).

## RESEARCH AIM AND QUESTIONS

This paper aims to shed the light on studies examining the effect of ‘technology generations’ on media use and the extent to which there is empirical evidence in seven countries for this concept. We aim to answer the following research questions:

*RQ1: Are there indeed previous studies providing empirical evidence for the existence of technology generations?*

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**Table 2.** Mean use of traditional and new media by technology generation and age group. *N* = 1,000.

	Technology generation	Household revolution	Mechanical	Total sample
<b>Traditional media use</b>				
Watching television	71.9 (9.1%)	75.7 (9.1%)	74.4 (9.2%)	74.0
Listening to music	52.9 (9.1%)	57.6 (9.1%)	55.5 (9.2%)	55.0
Using a newspaper, magazine or book	57.6 (9.1%)	57.1 (9.1%)	57.3 (9.2%)	57.3
Using a radio	56.3 (9.1%)	49.6 (9.1%)	50.7 (9.2%)	51.9
<b>New media use</b>				
Using text messages	19.7 (9.1%)	16.1 (9.2%)	17.1 (9.2%)	17.6
Using e-mail	7.3 (9.0%)	8.7 (9.0%)	7.6 (9.1%)	7.9
<b>People</b>				
Using a mobile computer	37.1 (9.2%)	34.1 (9.2%)	35.1 (9.2%)	35.4
Using a mobile phone	70.1 (9.1%)	71.3 (9.1%)	70.7 (9.1%)	70.7
Using a laptop or tablet computer	24.6 (9.1%)	15.7 (9.1%)	19.7 (9.2%)	18.3
Using a tablet computer	12.1 (9.1%)	5.7 (9.1%)	7.1 (9.1%)	6.3
<b>Older adults use technology applications</b>				
Using a dictionary	72.6 (9.1%)	70.3 (9.1%)	67.3 (9.2%)	70.1
Using a mobile phone	71.6 (9.1%)	71.3 (9.1%)	67.3 (9.2%)	69.7
Using a mobile phone calendar	52.7 (9.1%)	51.0 (9.1%)	52.1 (9.2%)	51.9
Using a mobile phone camera	40.1 (9.1%)	41.1 (9.1%)	37.7 (9.2%)	39.6
Using a mobile phone calculator	47.6 (9.1%)	51.6 (9.1%)	49.7 (9.2%)	49.6
Using a mobile phone calculator	38.1 (9.1%)	35.7 (9.1%)	32.1 (9.2%)	35.3
Using a mobile phone calendar	52.0 (9.1%)	49.1 (9.1%)	49.1 (9.2%)	50.1
Using a mobile phone calculator	33.0 (9.1%)	37.0 (9.1%)	34.1 (9.2%)	34.7
Using a mobile phone calendar	34.1 (9.1%)	36.7 (9.1%)	34.1 (9.2%)	34.6
Using a mobile phone	44.1 (9.1%)	41.3 (9.1%)	37.6 (9.2%)	41.0

*N* = 1,000. *n* = 100.

Following the age categories indicated by Sackmann & Winkler (2013), we used commensurate samples consisting of Internet users aged 60 years and older at the time we started collecting data in 2016. We selected the ‘mechanical generation’, which referred to those born in 1938 or before and who were therefore aged 78 and over; the ‘household revolution generation’, born 1939-1948 and aged 68-77 in 2016; and the ‘technology spread generation’, consisting of those born between 1949 and 1956 and who were therefore aged from 60 to 67 in 2016). We tested their use of and preferences in traditional media versus that of the new media with the aim of answering the following research questions:

*RQ2a:* Does the extent to which traditional media are used differ between the three technology generations?

*RQ2b:* Does the extent to which new media are used differ between the three technology generations?

The concept of a ‘technology generation’ might be restricted to the national contexts in which it has been tested (see also the review of previous studies in the next section). The next section will show that the empirical studies conducted in this field rarely use cross-cultural data. Our subsequent questions are therefore:

*RQ3a:* Do older people belonging to different technology generations from different countries have different media preferences?

*RQ3b:* Is there an interaction effect between country and technology generation on older people’s media use?

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Table 9. Empirical studies on technology generations and media use in older adults. The table lists the study, the country, the year, the sample size, the age range, the technology generation, and the media use outcome.

Study	Country	Year	Sample Size	Age Range	Technology Generation	Media Use Outcome
Sackmann et al. (1992a/b)	Germany	1992	1,015	15-25	1st	Computer use
Docampo Rama et al. (2001, 2002)	Netherlands	2001, 2002	23,000	15-25	1st	Computer use
Lim (2010)	UK	2010	1,015	10-30	1st	Computer use
Van der Goot et al. (2018)	Germany, Spain, UK, USA, France, Netherlands	2012	943-977	15-25	1st	Computer use
Sackmann et al. (1992a/b)	Germany	1992	1,015	15-25	1st	Computer use
Docampo Rama et al. (2001, 2002)	Netherlands	2001, 2002	23,000	15-25	1st	Computer use
Lim (2010)	UK	2010	1,015	10-30	1st	Computer use
Van der Goot et al. (2018)	Germany, Spain, UK, USA, France, Netherlands	2012	943-977	15-25	1st	Computer use
Sackmann et al. (1992a/b)	Germany	1992	1,015	15-25	1st	Computer use
Docampo Rama et al. (2001, 2002)	Netherlands	2001, 2002	23,000	15-25	1st	Computer use
Lim (2010)	UK	2010	1,015	10-30	1st	Computer use
Van der Goot et al. (2018)	Germany, Spain, UK, USA, France, Netherlands	2012	943-977	15-25	1st	Computer use

Our goal is to analyze the media formats (traditional versus new media) used by each of these three technology generations and to establish whether there are differences in preferences (time spent on the two types of media formats). We will first answer RQ1 by making use of a state-of-the-art review of empirical studies which analyzed technology generations. Then, RQ2a/b and RQ3a/b will be addressed by using data from a cross-national study in older adults conducted in Austria, Canada, Denmark, Israel, the Netherlands, Romania and Spain in 2016 and 2017, based on the data set from the ACT project: Older audiences in the digital media environment: A cross-national longitudinal study. Wave 1 Report 1.0 (Loos et al., 2018). More details about the methodology of this study are presented in the Method section.

## Review of previous empirical studies in the field

RQ1: Are there indeed previous studies providing empirical evidence for the existence of technology generations?

To answer this first research question, we present a review of the previous empirical studies in this field. A google scholar search (10.02.2019) using the key word ‘technology generation’ returned several hits for scientific publications on this topic that we discuss in this section. Note that we did not include studies on technology generations focusing on different generations of technological products, such as that of Stremersch et al. (2010).

Sackmann et al. (1992a/b) were the first to use the concept of technology generations, in a study based on data collected in Germany in 1992. We found six other studies (see also Table 9, including another empirical study from Sackmann

& Winkler (2013) also conducted in Germany; the empirical studies conducted by Van de Goor & Becker (2001), Docampo Rama et al. (2001) and Docampo Rama (2002) in the Netherlands; the empirical study from Lim (2010) using UK-based data; and the empirical study conducted by Van der Goot et al. (2018) across the six countries of Germany, Spain, UK, USA, France and the Netherlands. The oldest empirical study was conducted in 1992 by Sackmann et al. (1992a/b); the most recent, by Van der Goot et al. (2018), is based on data collected in 2012. The number of participants in the single country studies varied from 1,015 (Docampo Rama et al., 2001 and Docampo Rama, 2002) to 23,000 [Sackmann & Winkler, 2013]. In the cross-national study (Van der Goot et al., 2018), the lowest number of participants from any country was 943 and the highest, 977. Sackmann et al. (1992a/b), Docampo Rama et al. (2002), Sackmann & Winkler (2013) and Van der Goot et al. (2018) used surveys to collect the data; Van de Goor & Becker (2001) conducted a computer assisted face-to-face survey investigating the possession and usage of appliances, which included a 7-item sum scale for attitude towards technology; Docampo Rama et al. (2001) used experiments, while Lim (2010) made use of semi-structured interviews, content analysis, experiments and surveys. All seven studies used the concept of formative years, with Sackmann et al. (1992a/b), Docampo Rama et al. (2001, 2002) and Sackmann & Winkler (2013) identifying the ages of 15 to 25 as the crucial period during which the introduction of a new technology decisively impacts media usage in later years. Lim (2010) extends this to 10-30 years and Van der Goot et al. (2018) fail to specify any age range. Van de Goor & Becker (2001) state: “In social research the formative period is generally defined as the period between 10-25

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Table 1. The results of the ANOVA analysis of the interaction between age groups and technology generations on the dependent variable: frequency of use.

Tests of between-subjects effects						
Dependent Variable: Frequency of use						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Total	917.941 <sup>a</sup>	20	45.897	17.220	.000	.382
Age group	421.265 <sup>a</sup>	1	421.265	149.721	.000	.125
Gender	41.841 <sup>a</sup>	1	41.841	15.062	.000	.014
Generation	371.835	2	185.918	6.800	.003	.090
Age group * generation	373.820	12	31.152	1.128	.332	.061
Error	270.81482	18888	.01434			
Total	4467.200 <sup>a</sup>	18909				
Corrected Total	3715.11489	18908				

a. R Squared = .425 (Adjusted R Squared = .422)

years. We have to bear in mind that 10 and 25 are average ages. For some individuals the formative period will start and end somewhat earlier or later. In social research the hypothesis has been put forward that at about the age of the children start to acquire values, norms, attitudes and behavioral patterns. This does not primarily happen as a consequence of socialization in their parental home.” (p. 15)

All studies found empirical evidence for the impact of technology generations on domestic use of old and new media (for more information on the role of technology in everyday life, see Silverstone & Haddon, 1996; Hirsch & Silverstone, 2003; Haddon, 2004, 2011; Loos et al., 2008; Loos, 2012). However, they each examined different aspects of technology use.

Sackmann et al. (1992a/b) focused on household appliances (car, bicycle, TV, radio, record player, PC, washer, cassette recorder, motorbike, CD player, tape recorder) and found the following technological generations: the mechanical generation (<1938), the household revolution generation (1939-1948), the technology spread generation (1949-1963) and the computer generation (1964-1979), each characterized by different behavior “regarding the acquisition of goods and the ability to use them” (Sackmann, 1996, p.306).

Sackmann & Winkler (2013) identified four technological generations: the mechanical generation (<1930), the household appliances generation (1930-1945), the entertainment appliances generation (1946-1960), and the communication appliances generation (>1960) in relation to the possession and usage of, and attitude towards household, leisure and communication appliances.

User interfaces of electronic devices (telephone, TV, video recorder) formed the core of the empirical study conducted by Docampo Rama et al. (2001), who distinguished two technological generations: the electro-mechanical generation (people born before 1960) and the software generation (born in 1960 or later).

Docampo Rama et al. (2002) went on to investigate the use or non-use of the remote control (= display versus menu interaction style) to operate information, communication and entertainment appliances in a subsequent study and identified the same two technological generations as in her previous research, i.e., the electro-mechanical generation (people born before 1960) and the software generation (born in 1960 or later).

In the study conducted by Lim (2010), the focus was on the past experiences and familiarity people had with a variety of everyday domestic consumer products, such as radios, cameras, telephones, vacuum cleaners and TVs. The following technology generations were identified: the electro-mechanical [EM] generation (aged 46 and older) and the digital software [DS] generation (aged 45 years and under). The aspect of the private use of information and communication technologies (internet use, e-mail, social media) was researched by Sackmann & Winkler (2013), who found five technology generations: the mechanical generation (born before 1938), the household revolution generation (age group born 1939-1948), the technology spread generation (born 1949-1963), the computer generation (age group born 1964-1979) and Internet (people born later than 1979).

Van der Goot et al. (2018) were able to distinguish the newspaper generation (born 1930-1957), the

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Table 9. Results of the seven empirical studies on the impact of technology generations on older adults' media use.

Model	Control Variables	ΔR <sup>2</sup>	ΔAIC	F	β
Control	17%	-	270.21	2.04	.00
1. Control	22%	.05	267.95		
2	27%	.05			

ΔR<sup>2</sup> = adjusted R-squared; ΔAIC = adjusted Akaike information criterion.

Table 10. Results of the seven empirical studies on the impact of technology generations on older adults' media use.

Model	Control Variables		Interaction	T	β
	β	SE			
Control	0.00	0.00	0.00	0.00	0.00
1. Control	0.00	0.00	0.00	0.00	0.00
2. Control	0.00	0.00	0.00	0.00	0.00
3. Control	0.00	0.00	0.00	0.00	0.00
4. Control	0.00	0.00	0.00	0.00	0.00
5. Control	0.00	0.00	0.00	0.00	0.00

ΔR<sup>2</sup> = adjusted R-squared; ΔAIC = adjusted Akaike information criterion.

TV generation (born 1958-1977) and the Net generation (born 1978-1995). We refer to Table 9 for a specification of the technology generations identified by the seven empirical studies.

While the results of the previous seven empirical studies (for a more detailed overview of these studies we refer to Table 9 clearly provide empirical evidence for the existence of technology generations, we wish to emphasize that they are not deterministic and that the following points should be taken into consideration:

(1) Not all older people in a specific technological generation necessarily have the same characteristics. Or, as Sackmann & Winkler (2013) state: "Generational differences in technological practice are not coercive features for individual, but just probabilistic relations, open to individual and collective change and social structures." (p. 494)

(2) It may well be that age also plays a role in differences in technology usage patterns. Age effects were addressed in three of the seven empirical studies we reviewed:

Van de Goor & Becker (2001) [2] argue that "since Sackmann & Waymann did not study the possibility of age effects, they were not able to conclude if the found effects really constituted technology generation effects or age effect" (p. 17). In their own study, they conclude: "We (...) found age to have an effect on the possession of multi-layered (communication) appliances. This implies that with advancing age, future elderly might purchase a smaller amount of these appliances." (p. 125)

Docampo Rama et al. (2001) state [3]: "(...) both age and generation are based upon the year of

birth, how we can operationally distinguish between age effects and (technology) generation effects? Following general sociological methodology (Glenn, 1977), different generations are defined on the basis of rather sudden, discontinuous changes in society such as wars, economic depressions etc., and consequently generation effects should reflect such discontinuity. Age effects are different since these are assumed to be rather continuous" (p. 28). They also argue: "In the present study, we will try to separate age effects from generation effects by choosing sub-

jects from suitable age cohorts such that the transition from electromechanical to software style user interfaces is suitably covered. If performance declines continuously with birth cohort, we will interpret this as an age effect, but if it declines discontinuously with birth cohort, we will interpret this as a generation effect. More specifically, we will look for any discontinuity appearing at the birth cohort of about 1960, when the predefined EM-generation changed into the S-generation; Combined continuous and discontinuous effects of age and generation may also occur but will be more difficult to analyze operationally" (pp. 28-29). Docampo Rama et al. (2001) conclude that "(...) task duration has been found to increase monotonously with increasing age in conformance with the literature, and seems unrelated to generation differences." (p. 39).

In their subsequent study, Docampo Rama et al. (2002) [4] argue that "empirically, this generation effect is difficult to distinguish from an age effect, as both technology generations and age are measured by the subject's year of birth. Sociological methods tackle this problem by analyzing an age effect, whereas a discontinuous trend indicates a generation effect (Glenn, 1977)," (p. 36). In the presentation of their empirical results, nowhere do they discuss any age effect.

(3) It is also important to note that, although older adults may be slower to purchase new technology than the young (Sackmann et al. (1992a/b; Van de Goor & Becker, 2001), they nonetheless tend to do so in the end. As Rogers (2003) writes (see also Sackmann & Waymann, p. 496), successful innovations are first

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**Table 1** Descriptive statistics of the variables used in the analysis: *N* = 10527

Model	Age of Sample	<i>N</i>	Age of Sample	<i>T</i>	<i>SD</i>
Internet	2007-2012	10527	67.57	2.57	3.06
Internet	2007-2012	10527	67.57	2.57	3.06
Internet	2007-2012	10527	67.57	2.57	3.06

**Table 2** Descriptive statistics of the variables used in the analysis: *N* = 10527

Model	Undernumbered		<i>T</i>	<i>SD</i>
	<i>N</i>	<i>SD</i>		
Internet	10527	3.06	10527	3.06
Internet	10527	3.06	10527	3.06
Internet	10527	3.06	10527	3.06
Internet	10527	3.06	10527	3.06
Internet	10527	3.06	10527	3.06

## METHODS

### Sample

Traditional media are increasingly being challenged by the new communication practices of internet-based media. We therefore proposed to investigate older audience and processes of media displacement (Nimrod, 2017) using data from the first wave of the ACT project: Older audiences in the digital media environment: A cross-national longitudinal study. Wave 1 Report 1.0' (Loos et al. 2018). To our knowledge, this longitudinal study, which is investi-

used by 'innovators', 'early adopters', then by the 'early majority', followed by the 'late majority' and finally even by the 'laggards'. And Van de Goor & Becker (2001) argue: "Once members of an earlier generation have crossed the barrier and purchased a relatively complex appliance, they start to use it and use it equally often as member of later generations." (p. 124). Once they start using it, they build up experience that helps them to use the new technology. Hence, while a person may not have been exposed to a certain technology during his or her formative years, this can be compensated for by learning how to use it at a later stage. Hill et al. (2011) and Loos (2012) show that experience is more important than age when it comes to use of the internet at a later age. "It appears that daily internet use has far more impact on our navigation patterns than does the age. This shows that age is not the explanatory variable for the navigation patterns in information search behavior. Experience with internet plays a much more important role. In short, even if a person was not exposed to the internet during his or her formative years, this can be compensated by learning to work with the internet at a later age. Hence, in the case of navigation patterns the socialization theory does not apply to all senior citizens." (Loos, 2012, pp. 14-15)

(4) What also helps older people to start using a new technological device is enhanced user friendliness (e.g., the iPad). In other words, as Sackmann wrote, "after the innovation phase, intra-cohort development leads to a decrease in the distinctions between generations." (Sackmann, 1996, p. 306)

gating older audiences (aged 60 and above) and their media use within an inter-cultural context, with data being collected in three waves over a five-year period, is an unique attempt to map the dynamics of media use by older people. In the seven countries in which the study is being conducted - Austria, Canada, Denmark, Israel, the Netherlands, Romania and Spain - the samples consisted of Internet users aged 60 and over. Local companies were involved in the data collection process, which was performed using online surveys, except in Romania. There, the survey was conducted using Computer Assisted Telephone Interviews (CATI), as the percentage of Internet users among older people in Romania was estimated to be below 20 (Eurostat, 2017). Quota samples (using age and gender quotas) were created in each country with the aim of producing samples representative of the country's older online population. The overall sample (N=10527) consisted of Internet users aged 60 and older. Participants' ages ranged from 60 to 101, with a mean of 67.5 years (SD = 6.07), of whom 52% were men; 57% of the participants had attained a higher education or full university education; 45% reported having income higher than the average in their country and 15% declared their income to be lower than average. 72% were retirees and 13.3% worked fulltime.

### Data analysis

Based on the concept of 'technology generations' suggested by Sackmann & Winkler (2013), we identified in the current data base the following three technology generations: the 'technology spread generation' (born between 1949 and 1956), the 'household revolution generation' (born between 1939 and 1948) and the 'mechanical generation' (born before 1939).

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Table 3. Descriptive statistics and reliability for the questionnaire

English name	Spanish name	Country	Gender	Age	Education	Income	Work status	Technology generation	Media use	Reliability
Men aged 65-74	Hombr@s de 65-74 años	Spain	Male	69.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85
Men aged 75-84	Hombr@s de 75-84 años	Spain	Male	79.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85
Men aged 85+	Hombr@s de 85 años en adelante	Spain	Male	87.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85
Women aged 65-74	Mujeres de 65-74 años	Spain	Female	69.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85
Women aged 75-84	Mujeres de 75-84 años	Spain	Female	79.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85
Women aged 85+	Mujeres de 85 años en adelante	Spain	Female	87.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85
Men aged 65-74	Hombr@s de 65-74 años	Spain	Male	69.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85
Men aged 75-84	Hombr@s de 75-84 años	Spain	Male	79.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85
Men aged 85+	Hombr@s de 85 años en adelante	Spain	Male	87.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85
Women aged 65-74	Mujeres de 65-74 años	Spain	Female	69.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85
Women aged 75-84	Mujeres de 75-84 años	Spain	Female	79.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85
Women aged 85+	Mujeres de 85 años en adelante	Spain	Female	87.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85
Men aged 65-74	Hombr@s de 65-74 años	Spain	Male	69.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85
Men aged 75-84	Hombr@s de 75-84 años	Spain	Male	79.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85
Men aged 85+	Hombr@s de 85 años en adelante	Spain	Male	87.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85
Women aged 65-74	Mujeres de 65-74 años	Spain	Female	69.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85
Women aged 75-84	Mujeres de 75-84 años	Spain	Female	79.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85
Women aged 85+	Mujeres de 85 años en adelante	Spain	Female	87.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85
Men aged 65-74	Hombr@s de 65-74 años	Spain	Male	69.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85
Men aged 75-84	Hombr@s de 75-84 años	Spain	Male	79.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85
Men aged 85+	Hombr@s de 85 años en adelante	Spain	Male	87.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85
Women aged 65-74	Mujeres de 65-74 años	Spain	Female	69.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85
Women aged 75-84	Mujeres de 75-84 años	Spain	Female	79.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85
Women aged 85+	Mujeres de 85 años en adelante	Spain	Female	87.5	Primary	Low	Unemployed	Traditional	TV, radio, newspaper	0.85

We will discuss the differences related to media use and preferences between these three technology generations and across the seven countries.

The SPSS v20 software package was used to analyze the data. First, we analyzed the differences between the three technology generations in terms of socio-demographic characteristics: country of origin, gender, education, and income and work status. Chi-square non-parametric tests were used to record these differences. Then, we used descriptive statistics to determine the percentage of older people using different media (traditional media and new media) within the three technology generations and we recorded differences of media use using one-way analysis of variance (ANOVA) and Fisher's least significant differences (LSD) tests.

Next, we created two indexes to investigate the preferences for media use among the members of the three technology generations:

- (1) The Importance of traditional media Index = Total time spent using different traditional media: (watching television on a TV set + listening to the radio on a radio set + reading newspapers/magazine in the printed version); and
- (2) the Importance of new media Index = Total time spent using different new media: watching television on a computer + watching television on a mobile phone+ listening to the radio on a computer + listening to the radio on a mobile phone+ reading online versions of newspapers/magazine)

Note that participants were asked to log their media use from the previous day and that minutes spent on different media were used to calculate the two Indexes. Next, we used two-way factorial ANOVA to investigate the importance of traditional vs new media among users in these three technology generations across the seven countries. Finally, a series of linear regressions were conducted to explore factors that predict media preferences (traditional versus new media), taking the technology generations and the socio-demographic data into account.

**RESULTS**  
**Background characteristics and countries among the three technology generations**  
 The three technology generations were not equally distributed in our sample (Ntotal =10527), reflecting an unequal distribution of older Internet users in different age cohorts. The 'technology spread generation'

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Table 3.2. Distribution of respondents by country, generation, and technology generation

Country	Generation	Technology Generation	Number of respondents	Percentage of total sample
Denmark	Household revolution	Mechanical	10	12.2%
		Electrical	15	18.8%
		Digital	25	31.0%
Denmark	Mechanical	Mechanical	10	12.2%
		Electrical	15	18.8%
		Digital	25	31.0%
Denmark	Electrical	Mechanical	10	12.2%
		Electrical	15	18.8%
		Digital	25	31.0%
Denmark	Digital	Mechanical	10	12.2%
		Electrical	15	18.8%
		Digital	25	31.0%
Austria	Household revolution	Mechanical	10	12.2%
		Electrical	15	18.8%
		Digital	25	31.0%
Austria	Mechanical	Mechanical	10	12.2%
		Electrical	15	18.8%
		Digital	25	31.0%
Austria	Electrical	Mechanical	10	12.2%
		Electrical	15	18.8%
		Digital	25	31.0%
Austria	Digital	Mechanical	10	12.2%
		Electrical	15	18.8%
		Digital	25	31.0%
Sweden	Household revolution	Mechanical	10	12.2%
		Electrical	15	18.8%
		Digital	25	31.0%
Sweden	Mechanical	Mechanical	10	12.2%
		Electrical	15	18.8%
		Digital	25	31.0%
Sweden	Electrical	Mechanical	10	12.2%
		Electrical	15	18.8%
		Digital	25	31.0%
Sweden	Digital	Mechanical	10	12.2%
		Electrical	15	18.8%
		Digital	25	31.0%

is the largest one, accounting for 56.3% of the total sample, the 'household revolution' generation comprises 36.4% from our sample, while the 'mechanical generation' is the smallest, compris-

ing a mere 7.3% of our sample (with percentages ranging from 12.2% in Denmark to 2.6 % in Austria). The differences between the three technology generations in our sample reflect the



Table 4. Differences in media use among technology generations

Media use	Technology spread generation	Household revolution generation	Mechanical generation
Traditional media	<ul style="list-style-type: none"> <li>Television: 70%</li> <li>Radio: 65%</li> <li>Newspaper: 55%</li> <li>Magazine: 45%</li> <li>Book: 35%</li> </ul>	<ul style="list-style-type: none"> <li>Television: 75%</li> <li>Radio: 70%</li> <li>Newspaper: 60%</li> <li>Magazine: 50%</li> <li>Book: 40%</li> </ul>	<ul style="list-style-type: none"> <li>Television: 80%</li> <li>Radio: 75%</li> <li>Newspaper: 65%</li> <li>Magazine: 55%</li> <li>Book: 45%</li> </ul>
New media	<ul style="list-style-type: none"> <li>Internet: 10%</li> <li>Smartphone: 5%</li> <li>Tablet: 3%</li> <li>Smart TV: 2%</li> <li>Smartwatch: 1%</li> </ul>	<ul style="list-style-type: none"> <li>Internet: 20%</li> <li>Smartphone: 10%</li> <li>Tablet: 7%</li> <li>Smart TV: 4%</li> <li>Smartwatch: 2%</li> </ul>	<ul style="list-style-type: none"> <li>Internet: 30%</li> <li>Smartphone: 15%</li> <li>Tablet: 10%</li> <li>Smart TV: 6%</li> <li>Smartwatch: 3%</li> </ul>

heterogeneity related to the Internet use among older adults (Loos, 2012): the oldest-old population (here described as 'mechanical generation') having the lowest percentage of Internet users, regardless the countries we take into consideration.

The data reveal gender differences between the three technology generations. As we move from the 'technology spread generation' to the 'household revolution generation' and the 'mechanical generation', we find slightly more male Internet users than female. Older Internet users tend to be mainly people who have attained an upper secondary or higher educational level across all three technology generations. Less than 10% of those in our sample fell into the category "up to lower secondary" education. Nonetheless, there are several differences in level of education between the three technology generations, with less well educated participants tending to be more concentrated in the 'mechanical generation' than in the two other technology generations. The interaction effect between gender and education shows that we have more women using the Internet than men, except in the category of users that have a "full academic" education, where more men were found to use the Internet than women. The differences between the percentages of, on the one hand, men and on the other hand, women with a "full academic" education using the Internet were found to increase from 5% in the 'technology spread generation' to 10% in the 'household revolution generation', and rising to 15% in the 'mechanical generation'. Income categories did not account for any significant differences in the three technology generations considered here. Regarding retirement status, as could be expected, the percentage of retired persons among members of the 'technology spread generation', in which more than one third of participants (37.6%) were still working either full or part time, was much lower than in the 'household revolution generation' and the 'mechanical generation', where respectively over 93% and 96% of the respondents were retired. We therefore expected differences in technology use among the three defined technology generations to be influenced by the differences in work status, education, and gender described here and controlled for these in a further analysis. We also tested whether preferences for using different media are better explained by age or by generation technology.

### Media use among members of the three technology generations

We analyzed differences in media use (traditional and new) and we recorded the differences found between the three technology generations (Table 4). Indeed, the use of traditional media by the 'technology spread generation' tended



# The impact of 'technology generations' on older adults' media use

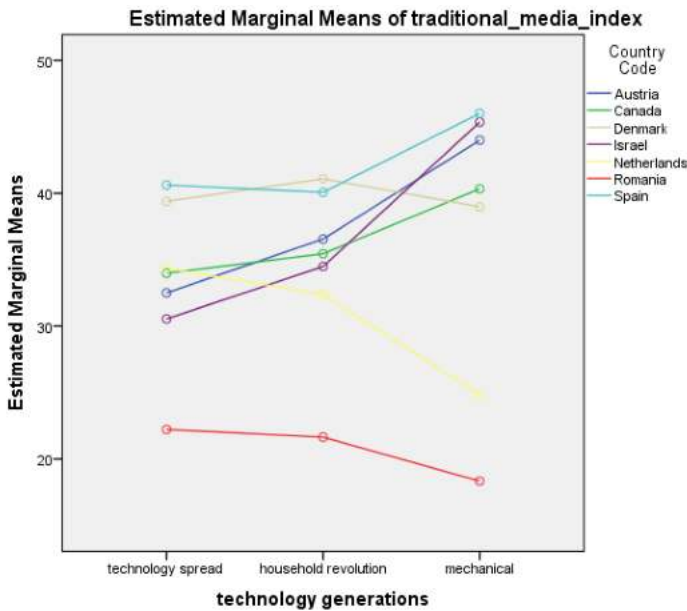


Figure 1. Profile plot of technology generations and country of origin on the importance of the traditional media Index.

to be lower than by the 'household revolution generation' and the 'mechanical generation'. As we move from the 'mechanical generation' to the 'technology spread generation', the percentages of people watching TV on a TV set, reading printed versions of newspapers or books or using a landline to communicate decreased.

Differences between the three technology generations also emerge when comparing percentages of new media use. Moreover, the effect size of technology generations is stronger when it comes to the mobile phone applications. Hence, the use of new media and different mobile applications - from sending SMSs to chatting (instant messaging), and the use of social network sites or games on mobile phone - by members of the 'technology spread generation' is higher than by members of the 'household revolution generation'; but is higher in turn among members of the 'household revolution generation' than among those of the 'mechanical generation'. An interesting finding meriting further discussion in future studies is the relatively large percentage of older people across all three technology generations reading newspapers/magazines online (ranging from 52.3% in the 'technology spread generation' to 42.6% in the 'mechanical generation').

### Differences between the technology generations in the importance of traditional vs new media in different countries

The data presented in Tables 3 and 4 offer support for the concept of 'technology generations' and for a generational effect in the use of tradi-

tional and new communication media. Still, the generational effect on different media use might differ in certain respects in each of the countries from our sample. To investigate this, we performed a two-way factorial ANOVA, using the Importance of traditional media Index and the Importance of new media Index as dependent variables, and technology generation and country of origin as main factors and interaction factors.

The country of origin generates a significant main effect on the preference of older adults for traditional media (the Importance of traditional media Index) -  $F(6, 6328) = 11.894, p < .011, \text{partial } \eta^2 = .011$  - and an interaction effect of country and technology generations is also seen in the preference of older adults for traditional media:  $F(12, 6328) = 2.213, p < .001, \text{partial } \eta^2 = .004$ . Still,

when assessing preferences for traditional media (Table 5), the main effect of country of origin was higher than the interaction effect of country of origin and technology generations.

We found no separate effect of the generations on the preferences for using traditional media formats,  $F(6, 6328) = 11.894, p = .009 < .01, \text{partial } \eta^2 = .011$ , thus accepting the null hypothesis of the relation between technology generations and preferences for using traditional media at older people,  $F(2, 6328) = 2.212, p = .11, \text{partial } \eta^2 = .001$ . The main effect of the country of origin on the preferences of older adults for traditional media could be also seen in the plot resulting from the analysis (Figure 1). Members of the 'mechanical generation', particularly in Romania and the Netherlands, showed less preference for traditional media, compared to Spain, Austria and Israel.

We found no main effect of generations on preferences for using new media formats,  $F(2, 10403) = .540, p = .540, \text{partial } \eta^2 = .000$ , and no interaction effect of country of origin and generations,  $F(12, 10403) = 1.081, p = .372, \text{partial } \eta^2 = .001$  (Table 6). Yet, country of origin was found to have a separate main effect on preferences for using new media,  $F(6, 10403) = 23.902, p < .001$ , and the effect size of the country of origin is large ( $\eta^2 = .014$ ). We plotted the different patterns of media use for the three generations in each of the countries in our sample (Figure 2). Analyzing preferences for using new media for the three generations yielded similar profiles for Romania and Canada on the one hand, and the

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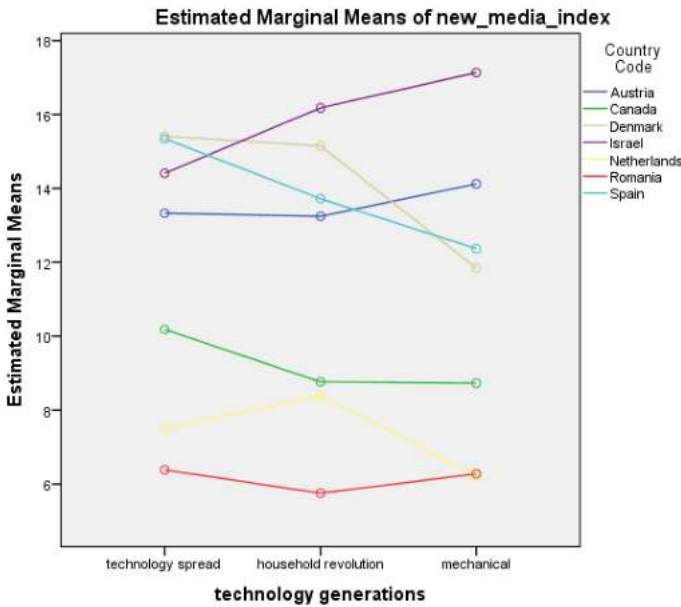


Figure 2. Profile plot of technology generations and country of origin on the importance of the new media index.

Netherlands and Denmark on the other.

Our data show that technology generation has a significant main effect on the preference for using traditional media (minutes spent using different traditional media formats). Also socio-demographic variables: country of origin, gender, working status and education play a role in the way people adopt and use different media formats (Table 3). To analyze the importance of technology generation in explaining the variance in minutes spent on traditional media, we conducted a linear regression using technology generation, gender (dummy, 1-man, 0-woman), educational level (educational attainment categories listed in Table 3) and working status (dummy, 1-retired) as predictors and the Importance of traditional media Index as a dependent variable. We also ran a similar model using age as the continuous variable instead of the technology generation (discontinuous variable).

The results of the linear regression analysis (Table 7,  $F(4, 5942) = 3.964, p = .003 < 0.1$ ) show that technology generation remains a significant predictor for time spent by older adults on different media formats, even after controlling for gender, working status and education ( $\beta = 2.296, t = 3.690, p < .001$ ). Still, this model can account for 5% of the total variation in traditional media use (R square = .05) and explains the similarities in variations in traditional media use across the seven countries in which the analysis was conducted. From the ‘technology spread generation’ to the ‘household revolution generation’, through to the ‘mechanical generation’, the length of time

in minutes spent by older adults using traditional media formats, regardless of gender, education categories and working status (retired or not), increased by 5%. Note that the socio-demographic predictors that account for differences between technology generations in media use (adoption) – see Table 2, do not explain the variance of time people spent on traditional media formats.

When running the analysis using age as the predictor (continuous variable) instead of technology generations, we obtained similar results (R square = .05); the regression model did not improve, showing that both age and generation technology could account for similar differences in the variance of the dependent variable: preferences for traditional media use.

Different results were found when running a linear regression using the same predictors: country of origin, gender, working status and education, technology generations and the Importance of new media Index (Table 8) as the dependent variable. Variance in each of the socio-demographic variables, including the technology generations, significantly influenced the variance of the dependent variable (the Importance of new media Index),  $F(4, 9686) = 21.491, p < .001$ . The model accounted for 10% of the total variation of new media use (R square = .098). From the ‘technology spread generation’ to the ‘household revolution generation’, through to the ‘mechanical generation’, the length of time in minutes spent by older adults using new media decreased by 2.8% after controlling for gender, working status and education ( $\beta = -.764, t = -2.596, p = .009 < .01$ ). In addition, men spent 6.2% more minutes on new media compared to women, regardless of educational level, working status or technology generation ( $\beta = 2.130, t = 6.067, p < .001$ ). Moreover, people with high levels of educational attainment spent more time on new media than those having a lower or medium educational level ( $\beta = 9.986, t = 4.931, p < .001$ ). Educational level accounts for 5% of the variance in the length of time spent using new media, when the other predictors are held constant. Similarly, being retired was found to impact the length of time in minutes spent using new media, shortening this by approximately 2.7% compared to older adults with jobs, after controlling for socio-demographic factors ( $\beta = -1.106, t = -2.518, p = .012 < .05$ ). Again, when running the analysis using age instead of age category (technology generation) as a con-

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tinuous variable, we saw similar results (R square =.09), with age (continuous variable) accounting for similar differences in the dependent variable, i.e., preferences for new media use.

In the case of the Importance of new media Index, we found an effect of technology generation, when controlling for gender, education and working status (being retired). As country of origin plays an important role in shaping older persons' new media use (Figure 2), we can say that the effect of technology generations on the preferences for new media are mediated by gender, education and working status (being retired), in the particular contexts of each country.

## CONCLUSIONS, LIMITATIONS, AND IMPLICATIONS FOR FUTURE RESEARCH

### Conclusions

*RQ1: Are there indeed previous studies providing empirical evidence for the existence of technology generations?*

Though the results of the previous seven empirical studies clearly provide empirical evidence for the existence of technology generations, it should be emphasized that that they are not deterministic and that not all older people in a specific technological generations necessarily have the same characteristics. Generational differences in technological practice are probabilistic relations (Sackmann & Winkler, 2013). Age may not be ruled out as playing a role in the differences related to technology usage patterns. Three out of the seven empirical studies we reviewed addressed these age effects. Although older people may be slower than younger ones to purchase new technology (Sackmann et al. (1992a/b; Van de Goor & Becker, 2001), they ultimately do end up doing so. Another point to take into consideration is that even though a person may not have been exposed to a particular technology during his or her formative years, as time progresses, this can be compensated for by learning how to use this technology later in life. As Hill et al. (2011) and Loos (2012) show, experience is more important than age when it comes to using the internet at a later age. Daily internet use has far more impact on our navigation patterns than age. What also helps older people to start using a new device is enhanced user-friendliness (e.g. iPad).

*RQ2a: Does the extent to which traditional media are used differ between the three technology generations?*

We recorded lower percentages of traditional media use by members of the 'household revolution' generation than by those of the 'mechanical generation', and lower still by members of the 'technology spread generation'; in other words, the percentage of people watching TV on a TV

set, reading printed versions of newspapers or books or using a landline to communicate is shrinking. Being part of one of the three technology generations is a significant predictor of preferences for using traditional media (time spent using traditional media formats), while older people's gender, working status and educational attainment level do not account for significant differences in time spent on traditional media. Still, age (the birth year) accounts for an effect similar to technology generation on the variance in traditional media differences. In the sociological literature, a generation effect is difficult to distinguish from age effects (Docampo Rama et al., 2002). In the current study, we found that the effect of both age and generation accounts for the same variance in traditional media use by older people, whereas gender, education and working status do not play a role in the equation. Indeed, the effect is rather small: both the continuous variable of age and generation each separately account for approximately 5% of the variance in time spent on traditional media formats.

*RQ2b: Does the extent to which new media are used differ between the three technology generations?*

The percentage of older adults using new media is the highest in the 'technology spread' generation and the lowest in the 'mechanical generation', and this trend is most markedly visible in the use of mobile phone applications: SMS, chatting (instant messaging), social network sites and games on mobile phone. Members of all three technology generations were found to read newspapers/magazines online, ranging from 52.3% in the 'technology spread generation' to 42.6% in the 'mechanical generation'. Being part of one of the three technology generations could explain the preferences in a person's use of new media (time spent using new media formats), after controlling for gender, education and working status. However, in this case, gender (being male), working status (being employed) and education (high attainment level) were shown to be important predictors that explained between 3% and 6% of the variance in time spent on different new media. Again, the effect of age is difficult to isolate from that of technology generation, as both could be interchangeably used as predictors in explaining new media use.

*RQ3a: Do older people belonging to different technology generations and from different countries have different media preferences?*

Technology generation is a concept that has not been tested in cross-cultural research project before. In the current study, we used data gathered on adults aged 60 and over in seven countries: Austria, Canada, Denmark, Israel, the Netherlands, Romania and Spain. Country of origin was

# The impact of 'technology generations' on older adults' media use

found to generate a significant main effect on the preference of older persons for traditional media. Members of the 'mechanical generation' showed less preference for traditional media, particularly in Romania and the Netherlands, compared to Spain, Austria and Israel. Also, the country of origin had a separate main effect on older people's preferences for using new media.

*RQ3b: Is there an interaction effect between country of origin and technology generation in older people's media use?*

We found an interaction effect of country of origin and technology generation on the preference of older adults for traditional media, although the main effect of country of origin was higher than the interaction effect of country of origin and technology generation. As for the preferences for using the new media formats, we found no effect of technology generation, nor an interaction effect of technology generation and country of origin. Yet, country of origin had a separate main effect on preferences for using new media.

In conclusion, when empirically testing the 'technology generation' concept, it proved difficult to isolate the age effect from the cohort effect, and both cohort and age effect overlapped in explaining variances in older people's preferences for different media. When testing this concept in different countries, we found an interaction effect of

technology generation and country of origin in the case of old media preferences, and a main effect of country of origin for preferences in using new media. These results call for a more nuanced view in further empirical testing of generation effect on media use, by taking into account more contextual factors related to country's specificity.

## Limitations and implications for future research

The data related to older adults' media use and preferences were self-reported and delivered interesting insights into the existence of technology generations. It would also be interesting to use other methods such as tracking (Fernández-Ardèvol et al., 2019) to see the extent to which actual media use delivers the same results. Unlike other studies in this field that often focus on just one country, our empirical research project on technology generations comprised seven countries (Austria, Denmark, Canada, Israel, the Netherlands, Romania, Spain). However, future empirical studies should include additional (also non-western) countries. A longitudinal approach, following the media use and preferences of an ageing group of people using media that is also becoming older, is another important recommendation. The ongoing data collection for the ACT project (Ageing Communication Technologies) seven countries study in which we are participating will deliver the opportunity to make such an analysis after the third wave in 2020.

## Acknowledgements

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