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How older and younger people see technology in Northern and Southern Europe: Closing the generation gap

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J. Cañas-Bajo, J. Leikas, J. Jokinen, J.J. Cañas, P. Saariluoma. How older and younger people see technology in Northern and Southern Europe: Closing the generation gap. Gerontechnology 2016;14(2):110-117; doi:10.4017/gt.2016.14.2.010.00 **Background** Mental representations of technology can be affected by many social and biological factors. The aim of this study was to test the effects of two of these factors, age and culture, on how people mentally represent and experience technologies by comparing the conceptions of old and young people in Spain and Finland. Both Spain and Finland are European countries, but they are historically, geographically, and culturally very different. **Method** The study is framed within the life-based design (LBD) paradigm, where culture and age interact to define particular forms of life in which technology might be used and perceived differently. We hypothesised that there are differences in the mental representations of technology of Spanish and Finnish people, but that those differences are mediated by age. **Results** Our results showed that technology conceptions between the two countries differ when considering older generations. However, when we consider younger generations, the gap between the two countries regarding technology is smaller.

Keywords: technology generations, culture and technology, user perception

Technologies help improve the quality of human life. Two important questions are how technologies are represented in the human mind and how they are used and perceived by people. Mental representations of technology include elements of the system as it relates to the world, but they also contain cognitive and emotional elements that influence the relation of the user with the object[1-3].

In order to accomplish the mission of improving the quality of human life, designers must ask themselves whether people actually perceive and mentally represent technologies as helping them, and what role technology plays in their lives. These questions are in the agenda of researchers working on the human dimension of technology. For example, they are being addressed within the life-based design (LBD) paradigm[4,5]. For LBD, the basic question is how technology is incorporated and implemented in different everyday contexts and what the possible roles of technologies are in improving human life. For this, it is important to analyse life contexts and the possible ways that technology can facilitate people in reaching their goals during their normal lives. In LBD, regular human contexts have been termed "forms of life"[4,6]. Thus, any regular way of living for a person can be seen as a form of life, a way of doing things within a particular culture, social context, or biological factor (e.g. age), which can be taken as the ground for examining and developing technological products or services.

'Forms of life' were selected as the basic concept in LBD because they are sufficiently flexible. Being a soccer fan is a form of life, but so is being a Catholic, an Italian, a hunter, lonely, older, ill, or rich[4,6,7]. A form of life is simply a set of integrated regularities that people follow in their lives. People are surrounded by numerous forms of life and participate in an unlimited number of them. Thus, they follow the regularities defined by the various forms of life in which they participate. Two critical factors that determine particular forms of life, and which are the focus of our study, are culture and age. Being a member of a

certain culture and belonging to a specific generation are typical forms of life which overlap with each other. Catholics have different ways of worshiping than Protestants, and most old people consider different things important in life than do younger ones[8]. Since the rules of behaviour vary in different forms of life, it is meaningful to investigate how different forms of life affect users' conceptions of technologies. When developing services or artefacts for people, it is important for designers or interaction researchers to understand the nature of the form of life in question.

Although the modern world is becoming increasingly international, it does not mean the disappearance of cultures. People still have different national laws, habits, and practices; they have different religions, different languages, and different moral standards[9]. Similarly, countries differ along cultural dimensions that can determine forms of life and the way in which technology is used and perceived. In fact, the irruption of technology into the human way of life has given rise to the idea of technological forms of life. Technology externalises knowledge, speeds up life, and stretches out and changes the concept of distance[7], closely interacting with social, cultural, and biological ways of living.

Culture around ICT

Thus, although the culture around ICT (Information and Communication Technology) is sometimes seen as relatively similar in different countries as the systems and services are used worldwide, the transfer of attitudes towards and conceptions of technology from one culture to another is not necessarily smooth. For example, Sundqvist, Frank, and Puumalainen studied the influence of Hofstede's cultural dimensions (individualism, power distance, masculinity, and uncertainty avoidance) on the adoption of wireless communication and found that countries with higher uncertainty avoidance adopted new technological innovation slower than countries with higher tolerance[10]. Thus, for any internationally oriented design project and product, it is also important to understand how international and traditional components operate when people experience their products. Consequently, it is important to study international, modern, and traditional mental representations of consumers concerning objects.

An obvious assumption is that older people who have lived in a much less international world represent modern products differently from younger ones. For example, Prensky makes a distinction between digital 'natives' (who have grown up with digital technology) and digital 'immigrants' (adults who have come to it later in life)[11]. He argues that digital natives differ in their learning style from that of digital immigrants. They prefer interactivity, graphics, and pictures instead of words, and fast presentations rather than slower, step-by-step logical expositions. One can imagine that national cultures have a stronger influence on older people than on younger, more internationally oriented internet generations. However, we do not know whether essential cross-cultural differences exist between technology generations, though it is important to know this. In the field of gerontechnology, the term technology generation is defined as a group which experiences the adaptation of technology in a specific context and with the social changes that occurred during the lifetimes of the members of that group[12-15].

Today, the use of technology is growing increasing fast, meaning that younger generations have grown up in a highly digitised environment, and the learning process has been closely linked to these changes[16]. In most schools in Western and Westernised countries, students use these new tools to achieve their learning goals[17]. The Internet has created a new way of understanding communication, and the possibilities for young people in this field are endless. However, it is also important to realise that these changes are relatively new. For the older generations, these innovations were introduced during adulthood. Thus, their adaptation has been more difficult[18].

Adopting new technologies

Adopting new technologies comprises a number of factors related to their use. It is for this reason that the individual context of the users must be understood beyond generational differences[19]. This context might refer to socio-cultural aspects; different sectors of the population perceive different benefits of the use of technology, and they differ in their access to these new tools. These elements have a clear influence on adoption[20].

Currently, it is assumed that the countries of the West, as members of Europe or the United States, are framed within similar socio-cultural contexts. While during the last 10 to 15 years, popular culture has become globalised[21], factors such as social context, language or the recent history of a country can have a decisive and critical influence on the use of technology[22]. We assume that the socio-cultural elements pushing people towards technological use may be more common in younger generations than in older generations[11] and that this might differ depending on the country so that the technological generation gap might differ for each country. Thus, older people in countries with a high tolerance to uncertainty might reduce the technology gen-

eration gap since the culture as a whole more easily adopts new technological advances[10]. Interestingly, although European countries are on the top of the list of highest scanning, with the US and Japan, Spain, along with France and Italy, seem to be lagging behind in this process[23]. Thus, the way older and younger generations use and perceive technology might differ when we compare these countries with other countries that more easily adapt to technology.

Europe is particularly interesting with respect to technology generation and culture. It has been very strongly divided during the last century, but the European Union has worked for half a century to create a less divided Europe. Technology has also been internationalised over the past decades. Markets are dominated by international brands, which have unified technology conceptions. Thus, cultural differences exist but there are also many factors which build bridges over generations and cultural gaps.

In our study we explored whether cultural differences related to technical products would be evident when comparing the technological conceptions of people of different ages living in two very different European countries. Is the cultural gap between older people different than between younger generations? Specifically, we selected Finland and Spain as target countries. They are both in a common European framework, but there are essential linguistic historical and cultural differences between the countries. In particular, the older generations have lived in very different cultural and technological circumstances. For example, illiteracy problems were solved in Finland before Spain, and Finland has been a democratic and technology oriented country much longer than Spain. However, linguistically and culturally, Spain has always been a central part of a wider and international cultural community than Finland. In addition, the two countries differ in Hofsteder's 'uncertainty avoidance' dimension, with Spain having less tolerance to uncertainty than Finland[24-26]. Thus, these two countries provide good examples for studying cultural and national differences.

With this study, we propose a new way of understanding these technological differences. We believe that it is important to understand the perception that individuals have of technology in each country in order to better understand the different processes of adapting to new technologies by cultural context and generation. A good analysis of these factors would provide a perspective on how they affect the social, economic, and cultural differences across generations in Spain and Finland in the adoption and use of technologies.

We investigated if there are cultural and generational differences in the appreciation of factors such as ease of use, aesthetics, ecological features, brand name, reliability, durability, domestic content and novelty of technological features when purchasing technological products. In addition, we wanted to explore whether these two factors interacted so that possible cultural differences were less pronounced for younger people.

Method

Overview

To reach our goal we carried out a survey concerning the importance of different factors in technology when purchasing technological products. A web-based questionnaire was undertaken by Finnish and Spanish participants across different ages, genders, and technological backgrounds and skills. We classified the ages of the participants in three different groups. The classification is based on the idea of technology generations. Technology generations reflect the historical timing of technology innovations and their diffusion into productive and cultural spheres, linked with the time period in which a cohort comes of age[27]. One reason for understanding this concept in product design is that people learn to use technologies at a certain age, and this understanding of how to use technologies (present and future) is built on the kind of knowledge that is typical for that cohort[28].

The questionnaire consisted of a series of questions related to the appreciation of different aspect of technology that people could consider when buying new technological products (e.g. ease of use, aesthetics, durability). These aspects were selected based on the basic idea of LBD, in that understanding the cognitive and emotional value of the product for the user in the context of culture and life is critical for the success of the product design[4,5]. The aim was to find the factors that could be connected to global objectives that people might value when purchasing and using technology. Because technology is a wide concept, we focus the questions on communication technologies such as telephones and computers. The advantage of focusing on communication technologies is that they have grown so rapidly that it is possible to study their adoption while it is still ongoing, and to understand developmental trends in technological gaps across generations and cultures[16].

Participants

Seven hundred and ninety-three participants filled out the questionnaire, 653 from Finland and 140 from Spain. The average birth year for the Finnish participants was 1978 (MDN=1985, SD=14.18), and for the Spanish participants it

was 1973 (MDN=1975, SD=12.3); 67.2% of the Finnish respondents were women, and 53.6% of the Spanish respondents were women. We divided the data into three generations (technology generations): 1945–1964, 1965–1980, and 1980–1992. Due to the discrepancy between the number of Spanish and Finnish participants in the range of those born between 1930 and 1944 (Finland=147, Spain=2), participants from this generation were excluded from the analysis *(Table 1)*.

Because the study was conducted from Finland, access to the Spanish sample was limited, resulting in a reduced sample. Thus, the distribution of the Finnish and Spanish datasets differed in the number of participants across the technological-generation categories, which may cause problems for ascertaining the internal validity of the study. However, although with caution, the consistency of the data may provide valuable information about the aspects of technological products for Spanish and Finnish participants.

The technological background of the participants was measured with a self-assessment computer skills scale ranging from 1 to 4. As mentioned below, The Finish and Spanish participants were equated in their self- assessed computer skills.

Procedure

All participants filled out a questionnaire regarding how important they felt different aspects of technological products were when purchasing new technology. The questionnaire was presented online in both Finland and Spain, and the participants responded to the questions using their own computers. To provide a context for the participants when rating technological products, the instructions exemplified the advance of technology regarding telephones and computers and the participants were instructed to their answers to the use of communication technologies, and more concretely, to the use of phones and computers. Once they read the instructions they had to press a key to start the questionnaire. Participants were presented each item on the screen with a printed scale below (from 1 to 4). They were asked to respond by choosing the value with a radio button in the computer.

The data were collected in two different rounds (2011 and 2014). Both the Finnish and Spanish questionnaire contained eight items concerning the importance of some features when considering acquiring new technology: ease of use, aesthetics, ecological aspects, brand name, reliability, durability, domestic content, and the newest technological features. In addition, the Finnish dataset included one more item regarding affordance. Participants had to rate the importance of each of these aspects on a scale from 1 to 4, where 1 represented 'Not important at all' and 4 represented 'Very important'.

Table 1. Distribution of technology generation (birth years) between the countries; Percentages are within countries

Country	%		
	1945–1964	**1965–1980**	**1981–1994**
Spain	23.6	40.7	35.7
Finland	18.5	15.5	66.0

Statistical analyses

Participants' ratings regarding self-assessment of their computer skills were analysed first by using independent samples t test (*Table 2*). In order to assess the possible effects of country, generations and their interactions for each of the importance scales, we performed general linear model analyses. As each factor represented and independent question, a separate model was constructed for each item in the questionnaire. In the model, the dependent variable was one of the interval scaled appreciation variables (ease of use, ecological aspects, aesthetics, etc.), and the independent terms were country, technology generation, and interaction between these two. We followed the significant interaction effects with pairwise Mann Whitney U comparisons for a more detailed analysis. Further, effect sizes (Cohen's d) were considered.

Results

Participants' self-ratings

The mean ratings for both the Finnish and the Spanish samples was 2.5, with statistically non-significantly different means: $t(186)=825$, p=0.41. This result is important for the internal validity of cross-cultural analyses because the differences observed below are unlikely to be due to differences in technological skills. In addition, for both countries, the connection between technology generations and computer skills was the same for both countries, with the older generation reporting the least computer skills (Finnish: 2.4; Spanish: 2.0) and the middle generation the most computer skills (Finnish: 3.0; Spanish: 2.8).

Answers to the questionnaire

Appendix 1 shows the mean ratings and standard deviations for each item in the questionnaire as a function of countries and technology generation.

Ease of use

The results of the analysis of the ease of use data showed a tendency for the older technological generation to give greater importance to the ease of use than the middle and younger generations. However this effect did not reach statistical significance ($\chi^2(1)=4.8$, p=0.090). Similarly,

Table 2. Means and standard deviations of the eight items in Spain and Finland and the different generations

Item	Generation					
	1945-1965		1965-1980		1981-1994	
	Spain	Finland	Spain	Finland	Spain	Finland
Ease of use	3.39±0.56	3.25±0.73	3.16±0.56	3.16±0.76	3.08±0.75	3.14±0.75
Aesthetics	2.48±0.62	2.12±0.75	2.56±0.84	2.69±0.79	2.66±0.72	2.74±0.83
Ecological aspects	2.79±0.78	2.24±0.76	2.51±0.85	2.41±0.88	2.30±0.81	2.43±0.85
Brand name	2.07±0.75	2.21±0.94	2.17±0.78	2.16±0.75	2.14±0.79	2.29±0.77
Reliability	3.20±0.67	3.65±0.55	3.55±0.57	3.54±0.63	3.63±0.57	3.58±0.55
Durability	3.24±0.58	3.49±0.61	3.47±0.57	3.44±0.66	3.59±0.67	3.57±0.57
Domestic content	1.86±0.83	2.64±1.01	1.58±0.74	1.97±0.89	1.77±0.80	2.05±0.86
New technological features	2.34±0.86	2.01±0.88	2.47±0.89	2.26±0.90	2.22±0.85	2.01±0.85

the effect of country ($\chi^2(2)=0.20$, p=0.650) and the interaction between country and generation ($\chi^2(2)=1.74$, p=0.420) were not significant, indicating that there were no differences between countries and generations in the importance they gave to ease of use when buying new technology.

Aesthetics

The results of the aesthetics scale showed a different pattern. Although there was no significant effect of country ($\chi^2(1)=0.95$, p=0.320), the effects of technological generation ($\chi^2(2)=19.24$, p<0.001) and the interactions between country and generation ($\chi^2(2)=6.62$, p=0.037) were significant (*Figure 1a*).

This interaction indicated that the older generation (1945–1964) attributed less value to aesthetics as an important feature when buying technological devices than did the younger generations, but this was especially true for the Finnish sample. The results of the Mann Whitney U test indicate that the only significant difference between countries was for the older generation (p<0.007, d=-0.54).

Ecological aspects

The results of the analysis on the ecological aspects data also indicated that country ($\chi^2(1)=4.87$, p=0.030) and the interaction between country and technological generation ($\chi^2(2)=10.92$, p<0.001) were significant. Mann Whitney U comparisons between countries at each level of generation indicated that for the older generation, there were differences between the Spanish and Finnish participants in the importance that they attributed to ecological aspects (p<0.001, d=-0.73). Spanish participants from the 1945–1965 generation tended to value ecological aspects more than any of the other groups, whereas the Finnish participants of this same generation tended to value this aspect less than other groups (*Figure 1b*).

Brand name

In contrast, the importance of brand name does not seem to vary depending on country ($\chi^2(1)=1.38$, p=0.240) or generation ($\chi^2(2)=0.69$, p=0.710), and there was no interaction between these two variables ($\chi^2(2)=1.97$, p=0.370). In general, when looking at responses to this item (*Figure 2*) in relation to other items in the questionnaire, brand name does not show much variation across groups, and it seems to be rated as less important than other dimensions.

Reliability

The results of the analysis on the reliability data indicated that although the main effect of generation was not significant ($\chi^2(2)=5.03$, p=0.080), the effect of country ($\chi^2(1)=6.2$, p=0.010) and the interaction between generation and country ($\chi^2(2)=12.6$, p=0.002) were significant. This interaction indicated that for the older generation, Finnish participants gave greater importance to reliability of the product than the Spanish participants (p<0.001, d=0.76), whereas this difference disappeared for the middle (p=0.650) and younger (p=0.520) generations (*Figure 1c*).

Durability

The results of the analysis of the durability data showed that country did not reach significance ($\chi^2(1)=2.53$, p=0.110). However, the effects of generation ($\chi^2(2)=14.96$, p=0.001) and the interaction of country and generation ($\chi^2(2)=7.62$, p=0.020) were significant, indicating that durability was less important for the older Spanish generations (p=0.004, d=0.56; *Figure 1d*). The differences between countries were not significant for the middle generations (p=0.930) or younger generations (p=0.530).

Domestic content

The results of the analysis of domestic content (products made in the same country) data indicated that although country ($\chi^2(1)=27.84$, p<0.001) and generation ($\chi^2(2)=17.36$, p<0.001) were significant, the effects of the interaction of country and generation was not significant ($\chi^2(2)=4.35$, p=0.110). The Mann Whitney U test indicated that the Finnish respondents were more concerned about the nationality of technology in all three generations (older: p<0.001, d=0.83; middle: p=0.010, d=0.46; and younger: p=0.020, d=0.34). However, the younger generation gave less importance to this item (*Figure 1e*).

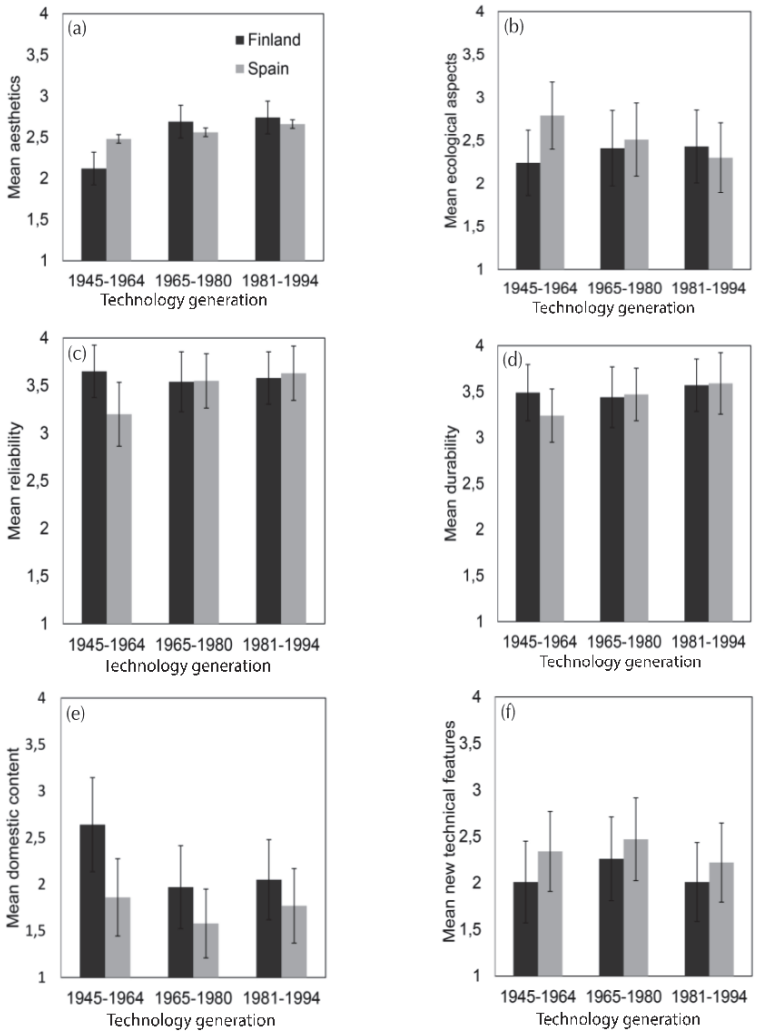

Figure 1. Mean ratings as a function of country and generation; error bars represent a 95% confidence interval; a. Aesthetics; b. Ecological aspects; c. Reliability; d. Durability; e. Domestic content; f. Newest technological feature

Newest technological features.

Similarly, the results of this item indicated significant main effects of country (χ^2 (1)=8.44, p=0.004) and generation (χ^2(2)=7.41, p=0.025). However, the interaction of country and generation did not reach significance (χ^2(2)=0.58, p=0.750), indicating that Spanish participants gave more importance to new technological features overall than did participants from Finland. This suggests that participants from the middle generation attributed more importance to new features than did participant from other generations (*Figure 1f*).

The mean difference between countries was significant in older generation (p=0.040, d=-0.38). However, there was no significant difference in the middle (p=0.140) and younger (p=0.140) generations. The middle generation gave more importance to the newest technological features.

General discussion

The aim of this study was to examine whether cultural differences in the perception of technological devices were evident when looking at the conceptions of people of different ages in two European countries, Spain and Finland, with different literacy and technological trajectories and with different weight on some cultural dimensions[24]. With this purpose, Finnish and Spanish participants of different generations (1945–1964, 1965–1980, and 1980–1992) were asked to answer questions related to their appreciation of eight different dimensions regarding technology that they take into account when purchasing technological products such as phones and computers. The basic idea, taken from the LBD approach, was that it may be possible to predict the success of a product based on factors related to the users' context of culture and form of living, which may influence the value of the product for the user.

The results indicated that although brand name and ease of use were valued to a similar degree by Finnish and Spanish participants across all technology generations, there were important differences regarding the dimensions aesthetics, ecological aspects, reliability, durability, domestic content, and the presence of new technological features in the product. Interestingly, aesthetics, ecological aspects, and newest technological details were dimensions with a low value for Finnish participants, especially for members of the older generation. In fact, the difference between Spanish and Finnish participants was significant for the older groups, with the Finnish older group showing a lower appreciation of these features than the older Spanish group. In contrast, older Spanish participants valued reliability, durability, and domestic content more than the older Finnish group. Thus, for all dimensions, the differences between Finnish and Spanish participants were evident only for older generations, and the differences disappeared or became smaller in the case of younger people.

Our results illustrate that there were cultural differences in the mental representations of technology. However, this cultural gap seems to be closing up. Hence, the results suggest that unified ICT culture may direct the values of the younger generations towards a shared, more unified way of seeing technologies. Techno-culture can thus be one unifying factor in Europe.

Although somewhat speculative, at a theoretical level, the notion of forms of life could help to explain these results. The culturally oriented way of doing things[7] is not constant but changes through history. Some important properties of a form of life can lose their meaning as a consequence of cultural developments. The results illustrate how important it is to study the interplay between different forms of life. Forms of life live, combine, and separate. Indeed, Dummett[29] offered an applicable metaphor for forms of life when he compared linguistic forms of life with the endlessly changing sea of meanings. Similarly, design and research must acknowledge the endlessly changing nature of technology in the contexts of life. Thus, while the perception of technology in Finland and Spain differ for older people, representing different forms of living and different uses of technological devices in normal life, these ways seem to have changed and developed with time so that differences in technological forms of life seem to dilute and converge in younger generations. Note that we are assuming that different technological generations represent different forms of life. It should be addressed, that if different ways of capturing forms of life have the same consequences in the way in which technology is represented.

Nevertheless, it is good to keep in mind that older people and older values are still here. Older people make independent technology acquisition decisions. Therefore, one should not underestimate the meaning of cultural differences when technologies are designed for seniors. This 'silver market' group is still influential. It is often quite well-to-do, and for this reason, it is not necessarily wise to design technologies for older people on the grounds of the internationalising values of young people. In designing gerontechnology, cultural differences still play a role.

Although our study has some methodological and theoretical limitations due to the differences in the number of participants or to the difficulties in operationalising forms of life, our results show a critical implication for designers. As the cultural gap is disappearing, culture-oriented design should be aware of the aspects that differentiate different generations in a specific period of time. Designers should be able to create modifiable technologies targeted at different user groups. In the field of human-technology interaction, the problem of design should be conceptualised and argumentatively supported using concepts and theories based on the analysis of everyday life, that is, the facts and values of life.

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