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A cross-cultural investigation on Smart Home Technology: the roles of digital competence, technophobia, technophilia, and trust

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A cross-cultural investigation on Smart Home Technology: the roles of digital competence, technophobia, technophilia and trust

Abstract. *Some individuals may feel threatened by the digital age, perhaps suffering from technophobia, whereas others are more technophilic, meaning they embrace new technologies. Relying on a study of 243 participants aged 18-65, this study explored the roles of technophobia, technophilia, trust in technology, and digital competence and how they interact within the SHT paradigm. Technophobia correlated positively with age and negatively with ownership of devices and most digital skills. Males outscored females for overall technological competence, especially in creative digital skills and technophilia. Spanish participants scored higher than English participants on operational digital skills, creative digital skills and technophilia-dependency. A hierarchical regression model with technophobia as the dependent variable showed that operational, navigational and mobile digital skills contributed negatively to technophobia. Technophilia-enthusiasm negatively predicted technophobia, whereas technophilia-reputation did so positively. Culture and gender were not significant predictors of technophobia in this context. There is a need to provide all sectors of society with opportunities to improve their digital skills to help people increase their self-efficacy and counterbalance any feelings of anxiety and technophobia that may appear in individuals who feel left behind by the modern digital world. The onus is for SHT manufacturers to design products that require no more than basic digital skills and are custom-made for different population cohorts within society.*

Keywords: *Technophobia, technophilia, digital competence, smart home technology.*

Una investigación intercultural sobre la tecnología del hogar inteligente: los roles de la competencia digital, la tecnofobia, la tecnofilia y la confianza

Resumen. *Algunas personas pueden sentirse amenazadas por la era digital y tal vez sufran de tecnofobia, mientras que otras son más tecnófilas, es decir, adoptan las nuevas tecnologías. Basándose en un estudio de 243 participantes de entre 18 y 65 años, este estudio exploró los roles de la tecnofobia, la tecnofilia, la confianza en la tecnología y la competencia digital y cómo interactúan dentro del paradigma SHT. La tecnofobia se correlacionó positivamente con la edad y negativamente con la propiedad de dispositivos y la mayoría de las habilidades digitales. Los hombres superaron a las mujeres en competencia tecnológica general, especialmente en habilidades digitales creativas y tecnofilia. Los participantes españoles obtuvieron puntuaciones más altas que los ingleses en habilidades digitales operativas, habilidades digitales creativas y dependencia de la tecnofilia. Un modelo de regresión jerárquica con la tecnofobia como variable dependiente mostró que las habilidades digitales operativas, de navegación y móviles contribuyeron negativamente a la tecnofobia. El entusiasmo por la tecnofilia predijo negativamente la tecnofobia, mientras que la reputación de la tecnofilia lo hizo positivamente. La cultura y el género no fueron predictores significativos de la tecnofobia en este contexto. Es necesario brindar a todos los sectores de la*

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sociedad oportunidades para mejorar sus habilidades digitales para ayudar a las personas a aumentar su autoeficacia y contrarrestar cualquier sentimiento de ansiedad y tecnofobia que pueda aparecer en las personas que se sienten abandonadas por el mundo digital moderno. Los fabricantes de SHT tienen la responsabilidad de diseñar productos que no requieran más que habilidades digitales básicas y que estén hechos a medida para diferentes grupos de población dentro de la sociedad.

Palabras clave: *Tecnofobia, tecnofilia, competencia digital, tecnología del hogar inteligente.*

Introduction

Technology is a fundamental component of modern society. Gradually, cities have undergone a digital transformation designed to improve citizens' lives and offer them greater comfort and convenience (Rao & Prasad, 2018). However, urban dwellers must embrace new technologies to ensure the success of these smart cities (Ju et al., 2018). At the same time, to successfully manoeuvre in modern society, it is essential to have some knowledge of technological functionality (Schauffel et al., 2021). In other words, individuals must have a sufficient baseline digital skill set to accomplish their goals and tasks. Nowhere is the concept of digitalisation more relevant than in the home. Indeed, most governments hope by 2030 to create fully automatized cities in which smart homes will play an essential role. (Nicolaides, 2021).

The aim of the smart home is not dissimilar to that of the smart city: to create a safe and comfortable environment based on the 5G grid system and interconnectivity. Smart home technology (SHT) generally works by intercommunicating using sensors integrated into devices that provide data analytics and information over a unifying cloud computing framework (Gubbi et al., 2013). Whether it is gaining information from a voice assistant or examining consumption data from a smart meter, a certain amount of interaction between the device and the user is necessary. However, researchers have questioned whether citizens will be willing or able to constantly communicate with technology at home (Reddick et al., 2020; Zhuravlev & Nestik, 2016). Digitally accomplished digital natives and other technophilic individuals will undoubtedly be enthusiastic users and make the most out of the smart home. By comparison, a swath of a population who distrust or do not understand technology, or who suffer from cyber anxiety or technophobia (Khasawneh, 2018), may be excluded from the possible benefits a smart home can bring (Selwyn, 2004), thus causing the digital divide to widen.

Digital competence

There is a distinct lack of research on how SHT use is affected by individuals' different levels of digital competence and the resulting gap in digital skills between different cohorts. Most articles that explore digital skills regarding smart technology focus on electronic education (Rizk & Davies, 2021), general health (Wang et al., 2022), people with disabilities (Kolotouchkina et al., 2022), age (Sala et al., 2020), social media (Mina, 2017) and gender (Gray et al., 2016). Articles that address the association between digital competence and SHT focus on specific products such as smart TVs (Kennedy & Holcombe-James, 2022) or Intelligent Voice Assistants (IVAs) such as Amazon Alexa. The use of IVAs has been found to lead to positive outcomes for people who may feel insecure about this technology. For example, children with autism gain essential life skills such as controlling SHT, ordering online, communicating with peers, and accessing information via interactions with IVAs. (Bheemaiah, 2021).

Moreover, people with special needs and the elderly can gain a sense of independence in a smart home by using voice and eye-tracking sensors to complete tasks and control home appliances (Klaib et al., 2019). In addition, a recent survey suggests that SHT is narrowing the digital divide, which encompasses differences in both access (first-level digital divide) and usage (second-level digital divide) of smart technology. Despite their lack of technical competence, older users reported being more satisfied with their smart devices than their younger counterparts (LG ThinQ, 2021). Although SHT can help less technically competent people in their day-to-day activities, they still need someone to assist them periodically, as technology is not failproof. Hence, a support system must be in place when the technology goes wrong or requires maintenance and updates.

Trust

Regardless of its positive aspects, SHT can be compromised. If an individual's trust in a smart device is breached, he or she may be left sceptical (Sun & Botev, 2021) and avoid using SHT, thus contributing to the digital divide. The fact that IVAs always listen is somewhat disconcerting and enables malicious attackers to act as virtual spies (Chung et al., 2017). The story of a hacker observing and speaking to a three-year-old via a baby monitor is a cause for concern when purchasing SHT (Wang, 2018). Such adverse incidents can lead to a lack of trust, and they can even have severe psychological effects and fuel anxiety and technophobia.

Technophobia and technophilia

Specific psychological barriers such as anxiety and technophobia have been found to affect sections of the population and to be more predominant among women, the elderly, racial minorities, and low-income families. This exerts a factorial causal effect on the digital divide (Dijk, 2017). In contrast, technophilic early adopters and innovators who are passionate and enthusiastic about the adoption of technology, especially new technologies such as SHT, are at the other end of the digital divide (Martínez-Córcoles et al., 2017; Osiceanu, 2015).

Although a few articles have addressed technophobia and/or technophilia concerning digital competence and the digital divide, no articles have explored the topic specifically regarding SHT. As stated previously, researchers generally examine the older population's degree of digital skills in conjunction with a specific smart product, usually with a focus on e-health (Cimperman et al., 2013). Technophobia has proved to be a significant predictor of low Internet use among the elderly (Anderberg et al., 2019; Nimrod, 2018, 2021). Technophobia was also a barrier to acceptance of technology in general, including SHT, for an older population whose in-

clusion in digital living was deemed inadequate, with effects on their quality of life (Di Giacomo et al., 2019). Indeed, technophobia can lead to feelings of societal isolation. It should be noted, though, that a systematic review of computer anxiety, a predictive factor for technophobia (Di Giacomo et al., 2019), uncovered mixed results (dos Santos & Santana, 2018). The authors found that females suffered from computer anxiety in 17 of the 39 papers reviewed, while males registered higher scores than females only once. Generally, older people suffered more anxiety than the young, highlighting a demographic digital divide, but some studies found no anxiety in the elderly participants (dos Santos & Santana, 2018). Thus, feeling anxious while using a computer is not based solely on demographics. However, this anxiety seems to affect females and the elderly more than young males, who are perceived as more technophilic (dos Santos & Santana, 2018).

Individuals who are technophiles will benefit from the digital world, especially as technology such as SHT becomes more pervasive and built into our daily lives. Technophilia is more than the acceptance and usage of technology, but suggests a purposeful enthusiasm, positive attitude, and attraction to all things digital (Osiceanu, 2015). Technophiles can be viewed as early adopters or innovators who create a buzz when new technology is released onto the market. Technophiles are concerned about their reputation and feel great joy in possessing the latest product, which they view as enhancing their status (Martínez-Córcoles et al., 2017). However, negative behaviour changes can sometimes appear among technophiles, such as dependence on technology to function in society and constant updates of devices to enhance their technoreputation, (Martínez-Córcoles et al., 2017).

Digital skills are intertwined with technophobia and technophilia. An individual who enthusiastically engages with SHT has self-efficacy and confidence in using these devices, even if they are not fully adept at using them (Myhre et al., 2017). On the other hand, a technophobe will not gain the necessary skills to use SHT because they do not want to engage, are afraid of making mistakes and ultimately do not accept the technology (Jung et al., 2010).

Purpose of this study

This study aims to go beyond the SHT acceptance discourse by examining the multiple interactions between the various constructs, namely, ownership, technophilia (and its subscales, technophobia, trust and digital competence), and intention to use and recommend the technology (IUR). Specifically, this study aims to clarify which digital skills play a significant role in technophobia and techophilia while using SHT. It is vital to measure individuals' levels of digital competence and possible signs of technophobia as we enter the smart society. People who have low levels of digital competence and/or suffer from symptoms of technophobia will find it harder to integrate into a digital society and could suffer from negative outcomes, including isolation. This paper will offer possible solutions to such negative outcomes.

In addition, the structural elements of age, culture (Spanish and English), and gender were also considered within the study. Adding the cultural aspect to the study will allow for a deeper understanding of the topic and help to highlight the matrix of behaviours, beliefs, and practices towards SHT, as well as the other measured variables (Ilesanmi, 2009). Moreover, the cross-cultural results should unearth some challenging questions and answers (as will the variables of gender and age), such as the prevalence or proclivity toward certain traits (technophobia and digital competence levels), the causes of these traits, and their effects on the individual and society (Ember & Ember, 2009). The study will also provide a barometer of how successfully individuals and specific cohorts manoeuvre in the modern digital society.

As smart home products become more ubiquitous, it is important to examine how particular sections of society adapt to the radical change from analogue to digital. It is in the interest of different societies and governments to know who will flourish in the smart society and who will not. This knowledge can inform solutions designed to create an inclusive digital society for all ages, genders, and digital literacies. Using SHT to measure the different variables is of great interest, as the home is becoming a major hub for smart products and technology usage. Additionally, choosing to measure the variable within a SHT paradigm is justified because from 2008 to 2016, time spent on technology increased twofold (Clark, 2019). Moreover, in 2017, people spent almost a third of their day using technology-based devices (Adobe Follow, 2018). The Covid-19 pandemic has only increased our time using smart devices at home. Still, even before that, many companies were already transitioning to a remote or hybrid working model to allow people to work from home. A wider selection of home-based technology options has led to increased time spent at home in recent years (White, 2018). Likewise, research on individuals' use of SHT is relevant because the home environment significantly affects people's behaviour and well-being (Araj, 2022). Individuals are more engaged and occupied at home when they have access to home leisure products (Wallsten, 2013) which increasingly take the form of time-consuming digital devices, including SHT.

To the authors' knowledge, no research conducted so far has measured digital competence, technophobia, technophilia and ownership in relation to smart home technology. The important take-home message from the present study is that smart home technology moves at a rapid rate, but can individuals stay abreast of its ever-changing nature.

Based on the literature, it is hypothesized that Pearson's correlation will show a negative correlation between technophobia and digital competence (H1), because technophobic people will use SHT less frequently and therefore garner less competence (or vice

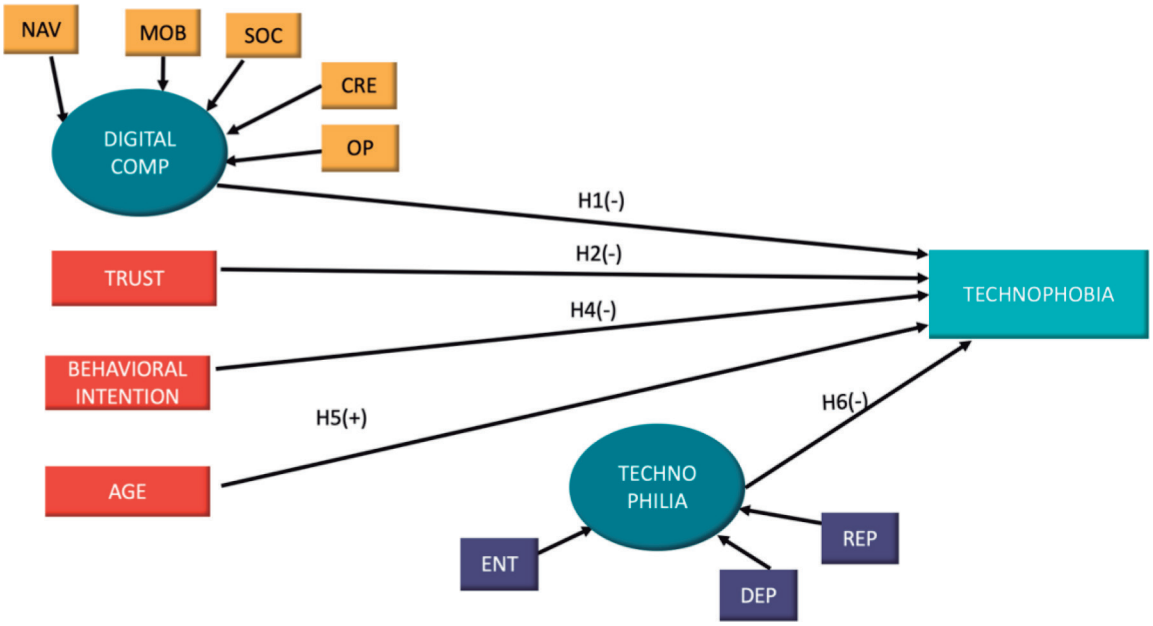

Figure 1. Proposed correlations between technophobia and digital competence, trust, behavioural intention and recommendation to use, age, and technophilia.

versa). Technophobia will also be associated with less trust in SHT (H2), less intention to use these products (H4) and greater ages (H5). It is also hypothesised that there will be a negative correlation between technophobia and overall technophilia (H6) (see figure 1). However, two of the technophilia subscales, reputation, and dependency, have both positive and negative outcomes, and it is therefore difficult to predict their influence prior to running the statistical analysis.

Although the previous literature on this topic is inconclusive, by running a comparison of means (see table 1), we assume that we will find that technophiles own more SHT devices than technophobes (H3), that males will score higher than females for technophilia (H7) and digital skills (H8), and that females will have higher scores in technophobia(H9). Global surveys show that Spanish society is among the most digitally connected in the world (Millet, 2020; Rodriguez, 2015), and it is therefore expected that the Spanish participants will be more technophilic (H10) and have greater digital skills (H11) than the English ones.

Method

Participants

A non-probability convenience sample of 248 individuals (56% women), with a mean age of 34 years (M = 33.53, SD = 13.448) were recruited online through social networks, including Facebook and Twitter. A number of participants were also recruited from forums dedicated to smart home technology found on various professional digital platforms such as LinkedIn. Participants lived in England or Spain and owned at least one smart device.

Instruments

The online battery consisted of an ad hoc questionnaire on demographic data, the type and number of smart home devices owned, and three scales evaluating trust in smart homes, digital skills, and technophobia/philia.

Technophobia and technophilia. Technophobia and technophilia were measured using English and Spanish scales (Martínez-Córcoles et al., 2017). This questionnaire was chosen because it measures both technophilia and technophobia, and the items on the technophobia subscale are less extreme than those used by Khasawneh (2018), thus allowing for a deeper examination of a broader spectrum of technophobia. The unifactorial technophobia scale consists of 12 items including, for example, "I feel an irrational fear of new equipment or technology". The reliability of technophobia in this study was α = .882. According to Mar-

Table 1. Expected outcomes of comparison of means

Hypothesis	Demographic	Outcome	Variable
H3	Technophiles compared to technophobes	>	Number of Devices/Ownership
H7	Males compared to females	>	Technophilia
H8	Males compared to females	>	Digital Competence
H9	Males compared to females	<	Technophobia
H10	Spanish compared to English	>	Technophilia
H11	Spanish compared to English	>	Digital Competence

Note. Outcome refers to first demographic cohort compared to the second. E.g., H3 Technophiles will have greater number of devices than technophobes.

tínez-Córcoles et al.(2017), technophilia is a construct consisting of three factors, each measured by a separate subscale: enthusiasm (8 items; α = .866 in this study; example: "I am excited for new equipment or technology"), dependency (6 items, α = .638; example: "I have spent more time using new equipment or technology than is reasonable") and reputation (4 items, α = .823; example: "I am afraid of failing if I can't use the latest equipment or technology"). For the purpose of this study, the items were adapted to address Smart Home Technology by changing the expression "technology" to "smart home technology." All items were answered on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). As the original scale has some psychometric issues (Martínez-Córcoles et al., 2017), a confirmatory factor analysis (CFA) was run on the technophilia scale, assuming a three-factor solution. The results of the chi-square test ($\chi 2 = 342.44$, df = 132, $p < .000$) allowed for the rejection of H0; however, the fit parameters (CFI = .865; RMSEA = .081) were not optimal, showing only a trend for the three-factor solution. Therefore, in the analyses, the scales were used as separate (independent) variables, and an overall score for technophilia was not used for the purpose of this study. Consequently, H6 will be replaced by H6a for technophilia (enthusiasm), H6b for technophilia (reputation) and H6c for technology dependence.

Trust in Smart Home. The Trust in the Smart Home Survey (Cannizzaro et al., 2020) consists of eight items measuring trust in different aspects of privacy, security, competence, and benevolence of smart home devices. For example, one item is "I would fully trust smart home devices not to fail, and to function as I expect them to". Reliability in the present study was α = .839. Participants were asked to indicate their level of agreement with each statement on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). For Spanish participants, the items were translated into Spanish.

Digital Skills. Digital skills were measured using the short version of the digital skills scale developed by Van Deursen et al. (2014). It includes 23 items in total; five items measure operational skills (OP), e.g. "I know how to upload files" (Cronbach's α = .764); five items measure navigation skills (NAV), e.g. "I find it hard to find a website I visited before" (α = .618); five items examine social skills (SOC), e.g. "I know when I should and shouldn't share information online" (α = .739); five items investigate creativity (CRE), e.g. "I know how to design a website" (α = .703); and three items measure mobile use (MOB), e.g. "I know how to install apps on a mobile device" (α = .576). For Spanish participants, the items were translated into Spanish. Each item was answered on a 5-point Likert scale, ranging from 1 (not at all true of me) to 5 (very true of me). The overall reliability of the scale is .641.

Intention to use and recommend SHT. This was measured using two items that assessed intention to use and intention to recommend (IUR) on a five-point Likert scale from Cannizzaro et al. (2020).

Procedure

The questionnaire battery was designed and distributed online via the survey software SoGoSurvey. Data collection took place from April to July 2022. Before completing the questionnaires, individuals were provided with an online consent form that informed them about the research aims and survey procedure. Participants provided informed consent by pressing the Yes/No tab. The questionnaire batch was posted repeatedly on as many online platforms as possible, asking for collaborations in a scientific study on Smart Home Technology. The English participants responded to the questionnaire in English, and the Spanish sample did so in Spanish. The only inclusion criterion was age > 18 years. The ethics committee of the authors' university approved the study protocol.

Data analysis

Descriptive statistics (means and standard deviations), multivariate analysis of variance (MANOVA) for gender and country, and calculations of correlations between variables and regression analysis were all carried out using SPSS 28.0.1.1. (14). For correlations involving age group, IUR, and ownership (number of devices owned), Spearman's rho (ρ) was used, and Pearson's r coefficient was used for the other variables. Confirmatory factor analysis for technophilia was performed using JASP.

Results

Descriptives

A total of 243 respondents (120 females, 123 males) completed the 30-item questionnaire battery. The two "other genders" were eliminated from the calculations, so the final sample resulted in 241 respondents (124 from the UK and 117 from Spain). Participants owned an average of 3.97 smart devices. Descriptive statistics (means and standard deviations for country and gender) are presented in Table 2.

Multivariate analyses

The results of the MANOVA showed that there were gender differences, as males owned more devices than females (F = 5.85, $p = .016$, η = .025). Males also scored higher than females in enthusiasm (F = 6.78, $p = .101$, η = .029), overall competence (F = 4.12, $p = .043$, η = .018), and creative skills (F = 13.30, $p = .001$, η = .056). With respect to country, Spaniards showed more dependency (F = 11.28, $p<.001$, η = .048), higher scores in operational skills (F = 6.77, $p = .010$, η = .029), and higher creative skills (F = 16.88, $p<.001$, η = .070). There were no cross-effects for country or gender.

Correlations

Age also correlated negatively with OP (ρ = -.273, $p<.001$), CRE (ρ = -.187, $p = .003$) and overall digital

Table 2. Descriptive statistics (means and standard deviations for country and gender

Variables	UK		Spain	
	Men n = 62	**Women n = 62**	**Men n = 61**	**Women n = 58**
Age	2.29 (1.63)	2.32(1.68)	2.30 (1.17)	1.88(1.17)
Number of devices owned	4.48(3.97)	3.07(2.43)	4.40 (3.37)	3.65 (2.34)
Enthusiasm	35.82(6.16)	33.31(5.93)	35.63(5.65)	33.93(5.13)
Dependency	20.44(4.91)	19.24(3.82)	21.97(4.64)	22.00(4.63)
Reputation	9.89(4.42)	11.10(4.25)	11.21(3.96)	11.21(4.58)
Technophobia	23.45(8.22)	26.11 (.9.54)	25.31 (8.48)	24.01(7.54)
Trust in SHT	23.40(6.42)	22.64(5.52)	21.87(5.28)	21.92(5.11)
Overall digital skills	88.01(7.77)	85.16(7.27)	88.65(5.79)	87.53(5.22)
Operational skills	24.04 (1.88)	23.5 (2.47)	24.36 (1.30)	23.36. (1.30)
Navigational skills	10.20(2.90)	10.42(2.90)	9.98(3.52)	10.31(2.75)
Social skills	22.69(2.10)	23.08(2.14)	22.51(2.30)	22.88(2.12)
Creative skills	16.77(4.75)	14.08(4.31)	16.79(3.19)	15.42(4.71)
Mobile skills	14.29(1.17)	14.05(1.38)	13.87(1.47)	14.16(1.28)
IUR	6.12(0.81)	6.18(0.95)	6.14(1.01)	6.25(0.86)

Note. Standard deviations are shown in parentheses.

Table 3. Pearson's Correlation analysis of study variables

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1. Technophobia	1										
2. Enthusiasm	-0.41**	1									
3. Dependency	-0.04	0.37**	1								
4. Reputation	0.45**	-0.01	0.26**	1							
5.Trust	-0.30	0.26**	0.11	-0.05	1						
6. COMP	-0.42**	0.35**	0.24**	-0.21**	0.06	1					
7. OP	-0.54*	0.25**	0.14*	-0.17**	0.03	0.54**	1				
8. NAV	-0.39**	0.07	0.14*	-0.12	0.01	0.20**	0.31**	1			
9. SOC	0.43**	0.16*	-0.19	-0.30*	0.01	0.49**	0.31**	-0.28**	1		
10. CRE	-0.35**	0.35**	0.28**	-,0.14	0.08	0.79**	0.34**	-0.07	0.18**	1	
11. MOB	-0.47**	0.20**	0.01	-0.20**	-0.00	0.48**	0.45**	-0.28**	0.46**	0.21**	1

Note. All abbreviations and meanings refer to online technology use. COMP-General Digital Competence. OP-Operational skills. NAV-Navigational Skills. SOC-Social Skills. CRE-Creative Skills. MOB-Mobile skills.
* p < .05. ** p < .01.

skills (ρ = -.244, *p*<.001). No correlations were found with trust. Ownership was positively related to all three technophilia subscales (enthusiasm: ρ = .341, *p*<.001; dependency: ρ = .430, *p*<.001; reputation (ρ = .275, *p*<.001), negatively but weakly related to technophobia (ρ = -.165, *p* = .012), and positively related to trust (ρ = .209, *p* = .002), OP (ρ = .166, *p* = .012), and CRE (ρ = .291, *p*<.001). IUR only showed a weak correlation (ρ = - .127, *p* = .048) with OP.

No correlations were found among age, ownership, and IUR. The other bivariate correlations (Pearson's) are shown in table 3 and figure 2. As can be seen, the three technophilia variables showed a peculiar pattern: enthusiasm correlated positively with dependency; dependency was also associated with reputation; but no correlation was found between reputation and enthusiasm. Enthusiasm correlated with overall digital skills and all subscales of digital skills. Dependency correlated positively with OP, NAV, CRE, and overall digital skills but not with SOC and MOB. Reputation was negatively correlated with OP, SOC, CRE, MOB, and overall digital skills.

Technophobia showed a negative correlation with technophilia-enthusiasm, positive correlation with technophilia-reputation, and no correlation with trust. Technophobia was negatively correlated with all digital skills. Trust showed only a positive correlation with enthusiasm.

Regression analysis

A regression model, with technophobia as the dependent variable, was adjusted for the data. The stepwise procedure yielded a significant model that explained 57% of the variance (adjusted $R^2 = 0.565$). As can be seen in table 3, operational and mobile skills contributed negatively to technophobia. Technophilia-enthusiasm negatively predicted technophobia, whereas technophilia-reputation did so positively. Culture, gender, and age were not found to be significant predictors of technophobia regarding SHT.

Discussion

The aim of this study was to go beyond the established SHT acceptance discourse by examining the multiple interactions between the various constructs, namely, ownership, technophilia (and its different aspects), technophobia, trust, digital competence (and its subscales), and intention to use and recommend the technology (IUR). This study has sought to clarify the

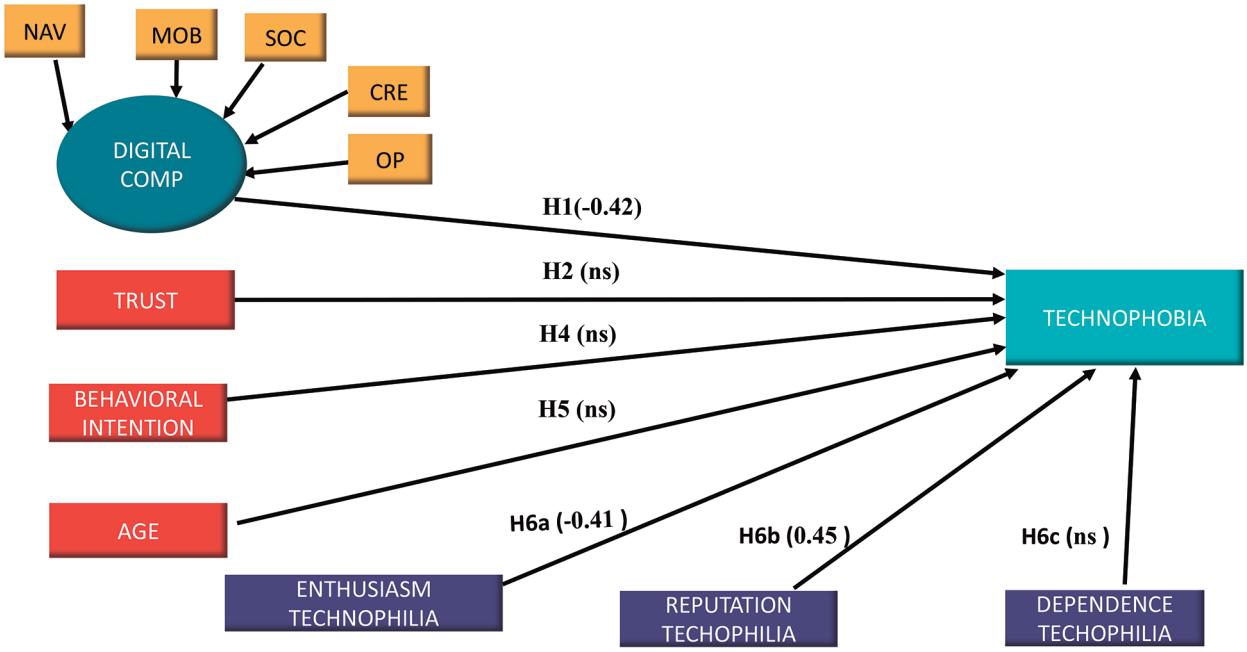

Figure 2. Technophobia correlation results.

Table 4. Regression analysis with technophobia as outcome variable

Variable	Standardized beta coefficient	t
OP	-0.280	-5.64
Reputation	0.343	7.89
Enthusiasm	-0.289	-6.57
NAV	-0.191	-4.22
MOB	-0.163	-3.35

Note: p-value was inferior to .001 in all cases.

relationship between specific digital skills (or the lack thereof) of technophobia and technophilia. Ownership and trust are also considered. In addition, the structural elements of age, culture (Spanish and English), and gender were also considered within the study. The correlations found between the variables allow for interesting conclusions and inferences regarding attitudes towards SHT and how individuals adapt to the ever-changing smart society. Some intriguing relationships found here add to the existing literature on SHT acceptance and technophobia.

Ownership

Owning SHT indicates that an individual has a positive attitude towards innovative technology. Such people have accepted a smart home device instead of a traditional appliance and are willing to use the device (Cannizzaro et al., 2020). Ownership was related to all three scales used to measure technophilia; the more enthusiastic an individual is towards SHT, the more products they own (Martínez-Córcoles et al., 2017). For technophiles, owning many SHTs enhances their self-perception within their peer group, which results in increasing their technophilic dependence by encouraging a further need for the latest smart devices. Conversely, technophobic individuals are less likely to own many smart home devices because technophobia is an irrational fear or rejection of new technology (Khasawneh, 2018). Ownership of SHT implies that owners are less anxious about technology, a concept supported by the existing literature, which shows a negative relationship between ownership and technology anxiety (Chou, 2003). In fact, avoiding SHT may only prolong anxiety, as owning and using technology decreases levels of anxiety and possible technophobia (Tekinarslan, 2008).

Ownership and Trust

Therefore, it is logical that ownership levels also correlate positively with trust, as technophilic individuals tend to ignore any negativity surrounding technology. These people tend to be more open and enthusiastic and to feel that technology is generally trustworthy, perceptions they gain from regular use (McKnight et al., 2011). Trust is gained through multiple interactions and intimate knowledge of SHT, which is only achieved through ownership and use (Delgosha & Hajiheydari, 2021). Trust is a central feature of SHT acceptance. Therefore, individuals with more SHT devices may trust SHT more (Cannizzaro et al., 2020; Wilson et al., 2017). Thus, it is feasible to suggest that participants who own more SHT disregard possible risks, such as data breaches, are more likely to believe that their data is secure and that technology manufacturers respect their interests. (Cannizzaro et al., 2020). Moreover, the results suggest that individuals who own many smart home devices tend to accept the element of risk, especially concerning privacy. In other words, their trust in these technologies outweighs the perceived risk (Michler et al., 2019). There is an abundance of existing literature on SHT and trust exploring the relationship between

end users and data, privacy and security (Aldossari & Sidorova, 2018; Schomakers et al., 2021; Shuhaiber & Mashal, 2019; Yang et al., 2017), yet no literature focuses explicitly on the relationship between ownership and trust. Although Cannizzaro et al. (2020) explore ownership and trust, they do not directly correlate the two constructs. Ownership of virtual smart home agents, such as chatbots embedded in smart devices, was explored and correlated with trust, as participants were sometimes suspicious and distrustful and wondered whom the agents really worked for, the end user or the manufacturer (Rodden et al., 2013). Another study on IoT home services correlated social trust with data on the various smart home devices owned. However, it was not the main thrust of the paper (Bouazza et al., 2022). To the author's knowledge, there is no literature focusing on the correlation between trust and ownership; therefore, the results of this study fill a gap in the existing literature. By showing a positive relationship between ownership and technophilia, this study suggests that trusting individuals were more likely to be enthusiastic technophiles, to be dependent on SHT and to own more home devices to enhance their techno reputation.

To increase adoption rates, smart home manufacturers and governments should incorporate trust and ownership mechanisms to motivate individuals to engage with SHT. Moreover, practitioners and policymakers should introduce more safeguards and tighter privacy and security infrastructure through legal contracts to encourage trust in SHT (Delgosha & Hajiheydari, 2021).

Technophobia and Technophilia

The digital skills that correlated positively with ownership but that contributed (negatively) to technophobia were the operational (OP) creative skills (CRE) and navigational skills (NAV), suggesting that individual owners view functionality (OP) and basic usage (NAV) as essential aspects of SHT, and that they use SHT creatively to add ambience to the home. One can also infer that creative SHT owners are more ambitious in their product decision process and tend to buy ambient-related products such as lights and speakers. As expected, technophilia-enthusiasm negatively predicted technophobia, but technophilia-reputation did so positively. This allows us to conclude that technophobia, at least as defined by Martínez-Córcoles et al. (2017), does not seem to be the opposite pole of technophilia, because the sub-variables behaved differently, not only concerning technophobia but also regarding digital competence. Digital competence and its subscales showed a positive correlation with technophilia-enthusiasm, and the subscales OP, NAV, and CRE were also positively associated with technophilia-dependence. However, the negative correlation between technophilia-reputation and most digital skills suggests that people with high scores for technophilia-reputation are less digitally skilled and, in part, purchase smart technology to enhance their status.

The result concerning enthusiasm and digital skills concurs with past research, which portrays enthusiastic technophiles as more open to gaining knowledge connected to technology (Ferreira & Oliveira, 2014; Van Deursen et al., 2014). A positive attitude (technophilia-enthusiasm) towards technology denotes a desire to have the know-how (digital skills) and expertise to use it efficiently. The empirical evidence indicates that enthusiasm breeds a desire to learn and gain more skills (Fannakhosrow et al., 2022; Hwang et al., 2021). An article on smart e-services and social networks supports the study's result. It concludes that its more enthusiastic participants were keen to gain greater knowledge on using the technology (Elena-Bucea et al., 2021; Quan-Haase et al., 2016). In addition, a study on digital media usage stated that enthusiastic individuals were the most skilled adopters of digital media, thus correlating the two concepts (Livingstone et al., 2017). Therefore, the results of this study agree with the literature on digital skills and competence, which has found that it is the early digital adopters and technological innovators who are the enthusiastic technophiles and who have an immense thirst to gain as much knowledge and as many skills as possible (Ferreira & Oliveira, 2014; Van Deursen et al., 2014). Additionally, a study on enthusiasts of technology devices, including SHT, showed that differences among gadget-loving individuals are most associated with learning motives rather than those associated with materialism. Once competence is achieved by improving digital skills, a sense of personal growth is observed (McManus & Carvalho, 2022). In real-world terms, education seems vital to improving the population's general digital competence, which would make even the technological hesitant or technophobe more accepting of SHT.

Considering that most day-to-day tasks depend on technology, a degree of digital competence is needed to navigate society (de Souza e Silva, 2017). However, dependency has negative correlates, and repetitive and consistent use of technology can lead to anxiety and addiction. Furthermore, dependency has been documented as causing an array of negative psychological states like a fear of missing out (Elhai et al., 2021), mood changes (Fardouly et al., 2015) and technostress (Mak et al., 2018; Shu et al., 2011). The concept of nomophobia, which refers to the fear of being without a mobile phone, affects around 40% of the global population (Archer, 2013; Mak et al., 2018). This creates a sense of irony where individuals who are enthusiastic about technology (technophiles) display symptoms of fearing technology (technophobia). Dependence on the smart home has yet to be examined in depth, possibly because these technologies are not as ubiquitous or socially invasive as other smart products. However, the SHT literature agrees that dependence could lead to severe effects on human behaviour and even bring about the so-called smart home paradox, whereby

people serve the SHT system rather than the system serving them (Sovacool & Furszyfer Del Rio, 2020).

Moreover, Wilson et al. (2017) believe dependence on sociotechnical systems such as automated home devices could lead to a loss of personal autonomy and independence and propagate laziness and the emergence of other "non-essential luxuries" (Wilson et al., 2017) within the home. Therefore, digital competence should involve not only operational, navigational, and functional aspects of technology but also social abilities, a variable that in this study did not correlate with technophilic-dependency (Martínez-Córcoles et al., 2017). This suggests that the technophilic-dependent individual is blinkered in their digital learning process and ignores the broader holistic knowledge base, which includes both the negative and positive sides of technology and SHT. As age is correlated negatively with technophilia-dependency, the younger generations have a less scrupulous attitude towards managing their technology usage and do not associate dependent use with adverse outcomes. However, problematic outcomes associated with the excessive use of technology have already come to the surface. Therefore, education in schools, plus substantial restrictions in the home, may alleviate the technophilic dependence of younger people. Moreover, SHT benefits like convenience and comfort (Balta-Ozkan et al., 2013) can lead to a lack of physical activity and laziness, a problem already seen in more established smart mediums, including smartphones and internet use (Buabbas et al., 2020; Kumar & Sherkhane, 2018). Practically, this means that everyone must take responsibility for their SHT usage and self-regulate to avoid dependence and its adverse outcomes.

Technophilia-reputation, meanwhile, reflects an individual's joy at having the latest product, enhancing their reputation (Martínez-Córcoles et al., 2017). However, the constant need to be up-to-date and have the latest products can lead to dependency and to a fear of missing out (Elhai et al., 2021), as well as to mood changes (Fardouly et al., 2015) and technostress (Mak et al., 2018; Shu et al., 2011). Moreover, the correlation between technophobia and technophilia-reputation adds to the argument that technophilia-reputation can be associated with adverse psychological outcomes.

Finally, technophilia-enthusiasm correlated positively with technophilia-dependency, and technophilia-dependency was associated with technophilia-reputation, but technophilia-reputation and technophilia-enthusiasm did not correlate. As discussed, technophilia-reputation can lead to adverse outcomes (Beyens et al., 2016), which may have conflicted with the more positive construct of technophilia-enthusiasm. Although the creators of the technophilia scale, Martínez-Córcoles et al. (2017), performed all the necessary procedures before confirming the scale's validity and reliability (multi-group analysis, CFA, Cronbach alpha, loading and goodness to fit), they did mention that the root mean square error of approximation (RMSEA) was slightly over the recommended cut-off value, which may have contributed to the irregularity between technophilia-enthusiasm and technophilia-reputation. In light of the present study's data, technophilia-enthusiasm, technophilia-dependency, and technophilia-reputation should be considered as entirely different constructs.

Demographics

The study's result indicating that the Spanish are more technologically dependent than the English is in line with the existing evidence, as the Spanish have been found to be more likely than other Europeans to be dependent on SHT and technology in general. A Technomic Index commissioned by the EU and Samsung, which included SHT, concluded that the Spanish were the most addicted to technology (Woollaston, 2014). A further study by Telefonica called *The Information Society in Spain* also concluded that Spain is the most connected country in Europe and in the top ten worldwide (Millet, 2020; Rodriguez, 2015). One reason for the phenomenon stems from the "Plan Avanza," a government initiative created to develop measures to extend the use of smart technology in homes and increase and promote their inclusion (Górriz & Gargallo, 2010). Spain also has the highest youth unemployment in Europe, which creates a lot of leisure time spent at home using smart devices (Moreno Mínguez, 2015). Educating the population on how to avoid technology dependency from an early age could solve the problem. However, with cities like Barcelona gearing up to be fully smart and automated, it seems that dependence on SHT may get worse before it gets better (Eskhita et al., 2021; Noori et al., 2020)

Age did not negatively correlate with technophobia; however, it did correlate with overall digital skills and technophilia, results supported by most of the existing literature (Folorunsho & Palaiologou, 2019; Hargittai, 2002; Hargittai & Walejko, 2008;). Younger generations are more likely to be technophilic and use technology than older individuals, creating a digital divide (McDonough, 2016). Introducing smart technology like smartphones and SHT has also exacerbated the divide between young and old (Smith, 2020). The reasons age negatively correlates with digital skills and technophilia include psychic costs such as fear of failure, greater risk aversion among older people than the young, and anxiety (McDonough, 2016; Scott, 2019). As the younger digital natives age, one can presume that the digital divide will diminish; however, as technology changes and morphs so quickly within small time frames, a divide will always exist. Therefore, it is imperative for individuals to stay abreast of the latest technology trends, especially with new technology like SHT, and to be ready to learn new digital skills, if they are to accept and use new technology successfully and ultimately remain relevant in the digital world.

There were no gender differences concerning technophobia, but gender differences were apparent insofar as males owned more devices than females, which

suggests a gender gap within the SHT ecosystem. The current literature concurs with the result and explains that it could be due to men believing that SHT is a type of replacement for the traditional housewife (Strengers & Nicholls, 2017). For example, according to the national smart home survey, almost 12% of men own SHT compared to 9.5% of women (Tolentino, 2016).

Another paper on ownership and anxiety concluded that males owned and used technology due to lower levels of computer anxiety (Baloğlu & Çevik, 2008). SHT is still quite task and goal orientated and is thus more attractive to males (Venkatesh & Morris, 2000). Moreover, men may view SHT as another thing to play and tinker with (Graziano et al., 2011, 2012; Su et al., 2009; Woodcock et al., 2012) while contributing to the maintenance of a home. To encourage more female owners, manufacturers could first promote ideals of liberation from domestic chores and the freeing up of time that SHT can afford, as it can perform the tasks females traditionally undertake in the home (Fortunati, 2017). Moreover, SHT should be marketed in such a way as to target the needs of different demographics, especially as the literature highlights females are more likely to accept SHT if their perceptions are addressed (Fortunati, 2017; Nikou, 2019).

Males also outscored females in technophilia-enthusiasm, which aligns with the existing literature on technophilia-enthusiasm (Brauner et al., 2017; Furszyfer Del Rio et al., 2021) and creative digital skills. The fact that men were found to be more technophilic in this study is congruent with past research, which argues that men are generally more favourable towards new technology than women (Graziano et al., 2011, 2012; Su et al., 2009; Woodcock et al., 2012). Men are more enthusiastic about their use of SHT due to feeling more protected, empowered and in control (Furszyfer Del Rio et al., 2021). In contrast, in a study by Brauner et al. (2017), females were less enthusiastic about using technology. Men perceive themselves as technology czars, someone who has a dominant or authoritative role technology, and, therefore, have more significant technophilic attitudes than females (Rode & Poole, 2018; Strengers, 2021). Other reasons identified for men's enthusiasm towards SHT include gender-role-specific socialisation (Prentice & Carranza, 2002), behavioural and cognitive stereotypes (Aronson et al., 2007) and benevolent sexism (Fehr & Fischbacher, 2004).

These reasons might help explain why men scored higher than females on specific digital competence. In fact, according to Sobieraj and Krämer (2020), women have lower general computer self-efficacy and therefore are more hesitant to develop their own abilities and to learn and improve their digital skills (Wild et al., 2012). Females are 25% less likely than males to know how to leverage digital technology for basic purposes, four times less likely to program computers and thirteen times less likely to file for a technology patent (West et al., 2019). Regarding technology use, women are less likely to know how to operate a smartphone, use social media, navigate the internet, and understand how to protect digitalised information (ITU, 2020). Although data regarding gender differences within technology is inconclusive, SHT offers an opportunity for an equality-based environment.

Digital Competence

CRE, OP, and NAV were the most significant subscales for measuring digital skills. As SHT becomes more incorporated into our daily tasks, we will have to gain additional creative, versatile skills that transcend what machines can do. Meanwhile, the Spanish scored highest on CRE, possibly due to them being the most frequent users of multimedia and online platforms in Europe. They also have a strong tradition of design and art, which may translate to the technological world. However, the result is not straightforward, as the Confirmatory Factor Analysis (CFA) executed by the authors of the digital skills scale indicated that the general population people are least confident concerning the CRE scale (Van Deursen et al., 2014.)

In contrast, the CFA highlighted that the general population felt most confident with the OP skills scale, which is reflected in this study. Moreover, OP skills, which deal with basic functionality, represent the baseline for technology use; without them, an individual cannot progress and excel in other digital skills. Therefore, they were significant because OP skills are the most general and vital, especially when one is learning to use and work with technology (Tramontano et al., 2021; Van Dijk, 2005). Whether using the internet or SHT, OP skills are vital to learning how technology works. NAV skills are also an essential feature of using or surfing the internet, and one of the first skills to learn is using the mouse to search for information online. This may be why it was significant, as it has been compared to the essential abilities of reading and writing (Di Giacomo et al., 2019; Osiceanu, 2015). The MOB skill scale was not as significant, which is surprising as it is currently the most used technology device and an essential apparatus when controlling SHT in the home.

Limitations

The present study has some methodological shortcomings, as the unsatisfying psychometric properties of the technophilia scale did not allow for a path model or mediation analysis. In terms of methods, a path analysis may have provided a deeper understanding of how all the factors interact within an SEM model. Future research should carefully select an appropriate scale to study technophobia and technophilia within the SHT paradigm. Research could expand the cultural perspective to represent samples outside of Europe to get a global sense of attitudes towards SHT. Although the sample of participants was sourced from professional online platforms, future research could categorise education levels and job/profession to better understand the classification of SHT. In the future,

research may want to investigate SHT use within a longitudinal framework to evaluate different acceptance and competence levels and whether they increase or decrease after the initial purchase of SHT products. Moreover, adding a mixed-method approach and assessing individuals within a live lab scenario may also shed light on real-world beneficial outcomes.

Conclusion

Among the study's main contributions is the fact that it was a unique multifactorial investigation, one which assessed factors that have either been understudied or not studied at all within the SHT paradigm. The results as to individuals' attitudes towards technophobia/philia, trust, ownership, and digital skills have moved the SHT usage narrative forward. The more flexible approach to measuring SHT used here is innovative and refreshing especially compared to previous research that utilised established models and theories, which for some researchers has reached a dead end (Benbasat & Barki, 2007; Martínez-Córcoles et al., 2017). Therefore, another contribution was breaking down and investigating the interplay between technophobia/philia and digital skills, as well as looking at ownership's relationship with trust and future intention to use.

Future research could continue along the same lines and delve deeper into how digital skills, technophilia, and technophobia relate to each other and affect individuals' behaviours when deciding to accept and how to use SHT. Age also proved valuable within the study, and the results aligned with the existing literature. The analysis of cultural differences did unearth some interesting assertions. However, future research could examine different perspectives from various continents and socio-economic backgrounds.

The results can be used as a guide or reference point by future academics, smart manufacturing researchers or governmental agencies looking to create large-scale infrastructures based on smart development research (Gascó-Hernandez, 2018).

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References

Adobe Follow. (2018). 2018 Adobe Consumer Content Survey. Share and Discover Knowledge on SlideShare. Retrieved September 15, 2022, from https://www.slideshare.net/adobe/2018-adobe-consumer-content-survey

Aldossari, M. Q., & Sidorova, A. (2018). Consumer acceptance of internet of things (IOT): Smart home context. *Journal of Computer Information Systems, 60*(6), 507-517. https://doi.org/10.1080/08874417.2018.1543000

Anderberg, P., Eivazzadeh, S., & Berglund, J. S. (2019). A novel instrument for measuring older people's attitudes toward technology (TechPH): Development and validation. *Journal of Medical Internet Research, 21*(5), e13951. https://doi. org/10.2196/13951

Araj, V. (2022, May 12). How your home can affect your well-being. How Your Home Can Affect Your Well-Being | Rocket Mortgage. Retrieved September 15, 2022, from https://www.rocketmortgage.com/learn/how-home-impacts-well-being

Archer, D. (2013). *Smartphone addiction*. Psychology Today.

Aronson, E., Wilson, T. D., & Sommers, S. R. (2007). *Social psychology*. Pearson Education India

Baloğlu, M., & Çevik, V. (2008). Multivariate effects of gender, ownership, and the frequency of use on computer anxiety among high school students. *Computers in Human Behavior, 24*(6), 2639-2648. https://doi.org/10.1016/j.chb.2008.03.003

Balta-Ozkan, N., Davidson, R., Bicket, M., & Whitmarsh, L. (2013). Social barriers to the adoption of Smart Homes. *Energy Policy, 63*, 363-374. https://doi.org/10.1016/j.enpol.2013.08.043

Benbasat, I., & Barki, H. (2007). Quo vadis TAM? Journal of the Association for Information Systems, 8, 212-218

Beyens, I., Frison, E., & Eggermont, S. (2016). "I don't want to miss A thing": Adolescents' fear of missing out and its relationship to adolescents' social needs, Facebook use, and Facebook related stress. *Computers in Human Behavior, 64*, 1-8. https://doi.org/10.1016/j.chb.2016.05.083

Bheemaiah, A. K. (2021). Voice user interface for the neurodiversant. https://doi.org/10.31234/osf.io/rnykw

Bouazza, H., Said, B., & Zohra Laallam, F. (2022). A hybrid IOT services recommender system using social IOT. *Journal of King Saud University - Computer and Information Sciences, 34*(8), 5633-5645. https://doi.org/10.1016/j.jksuci.2022.02.003

Brauner, P., van Heek, J., & Ziefle, M. (2017). Age, gender, and technology attitude as factors for acceptance of smart interactive textiles in home environments - towards a smart textile technology acceptance model. *Proceedings of the 3rd International Conference on Information and Communication Technologies for Ageing Well and e-Health*. https://doi.org/10.5220/0006255600130024

Buabbas, A. J., Al-Mass, M. A., Al-Tawari, B. A., & Buabbas, M. A. (2020). The detrimental impacts of smart technology device overuse among school students in Kuwait: A cross-sectional survey. *BMC Pediatrics, 20*(1). https://doi.org/10.1186/s12887-020-02417-x

Cannizzaro, S., Procter, R., Ma, S., & Maple, C. (2020). Trust in the smart home: Findings from a Nationally Representative Survey in the UK. *PLOS ONE, 15*(5).

Chou, C. (2003). Incidences and correlates of Internet anxiety among high school teachers in Taiwan. *Computers in Human Behavior, 19*, 731-749.

Chung, H., Iorga, M., Voas, J., & Lee, S. (2017). "Alexa, can I trust you?" *Computer, 50*(9), 100-104. https://doi.org/10.1109/mc.2017.3571053

Cimperman, M., Brenčič, M. M., Trkman, P., & Stanonik, M. D. L. (2013). Older adults' perceptions of

home telehealth services. *Telemedicine and e-Health, 19*(10), 786-790. https://doi.org/10.1089/tmj.2012.0272

Clark, K. (2019, June 11). Here's Mary Meeker's 2019 internet trends report. TechCrunch. Retrieved September 15, 2022, from https://techcrunch.com/

Delgosha, M. S., & Hajiheydari, N. (2021). How human users engage with consumer robots? A dual model of psychological ownership and trust to explain post-adoption behaviours. *Computers in Human Behavior, 117*, 106660. https://doi.org/10.1016/j.chb.2020.106660

de Souza e Silva, A. (2017). pokémon go as an HRG: Mobility, sociability, and surveillance in hybrid spaces. *Mobile Media & Communication, 5*(1), 20-23. https://doi.org/10.1177/2050157916676232

Di Giacomo, D., Ranieri, J., D'Amico, M., Guerra, F., & Passafiume, D. (2019). Psychological barriers to digital living in older adults: Computer anxiety as predictive mechanism for technophobia. *Behavioral Sciences, 9*(9), 96. https://doi.org/10.3390/bs9090096 International *Journal of Multicultural and Multireligious Understanding, 6*(2), 627. https://doi.org/10.18415/ijmmu.v6i2.706

Dijk, J. A. (2017). Digital Divide: Impact of Access. *The International Encyclopedia of Media Effects*, 1-11. https://doi.org/10.1002/9781118783764.wbieme0043

Dos Santos, T. D., & Santana, V. F. (2018). Computer anxiety and interaction. *Proceedings of the 15th International Web for All Conference*. https://doi.org/10.1145/3192714.3192825

Elena-Bucea, A., Cruz-Jesus, F., Oliveira, T., & Coelho, P. S. (2021). Assessing the role of age, education, gender and income on the digital divide: evidence for the European Union. *Information Systems Frontiers, 23*(4), 1007-1021.

Elhai, J. D., Yang, H., & Montag, C. (2021). Fear of missing out (FOMO): Overview, theoretical underpinnings, and literature review on relations with severity of negative affectivity and problematic technology use. *Brazilian Journal of Psychiatry, 43*(2), 203-209. https://doi.org/10.1590/1516-4446-2020-0870

Ember, C. R., &Ember, M. (2009). *Cross-cultural research methods*. AltaMira Press.

Eskhita, R., Manda, V. K., & Hlali, A. (2021). Dubai and Barcelona as Smart Cities: Some reflections on data protection law and privacy. *Environmental Policy and Law, 51*(6), 403-407. https://doi.org/10.3233/epl-210023

Fannakhosrow, M., Nourabadi, S., Ngoc Huy, D. T., Dinh Trung, N., & Tashtoush, M. A. (2022). A comparative study of information and communication technology (ict)-based and conventional methods of instruction on learners' academic enthusiasm for L2 learning. *Education Research International, 2022*, 1-8. https://doi.org/10.1155/2022/5478088

Fardouly, J., Diedrichs, P. C., Vartanian, L. R., & Halliwell, E. (2015). Social comparisons on social media: The impact of facebook on young women's body image concerns and mood. *Body Image, 13*, 38-45. https://doi.org/10.1016/j.bodyim.2014.12.002

Fehr, E., & Fischbacher, U. (2004). Third party punishment and social norms. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.495443

Ferreira, L., & Oliveira, L. (2014). The Myth of the Brave New Web Man. *6TH International Conference on Education and New Learning Technologies*, 6777-6785.

Folorunsho, A., & Palaiologou, I. (2019). The digital divide : Access, skills, use and ideological barriers. *Early Learning in the Digital Age*, 109-120. https://doi.org/10.4135/9781526463173.n8

Fortunati, L. (2017). Robotization and the domestic sphere. *New Media & Society, 20*(8), 2673-2690. https://doi.org/10.1177/1461444817729366

Furszyfer Del Rio, D. D., Sovacool, B. K., & Martiskainen, M. (2021). Controllable, frightening, or fun? exploring the gendered dynamics of Smart Home Technology Preferences in the United Kingdom. *Energy Research & Social Science, 77*, 102105. https://doi.org/10.1016/j.erss.2021.102105

Gascó-Hernandez, M. (2018). Building a smart city. *Communications of the ACM, 61*(4), 50-57. https://doi.org/10.1145/3117800

Górriz, C., & Gargallo, A. (2010). Review of Information Society State in Spain. *Revista Facultad De Ciencias Económicas, 18*(1), 43-60.

Gray, T. J., Gainous, J., & Wagner, K. M. (2016). Gender and the digital divide in Latin America*. *Social Science Quarterly, 98*(1), 326-340. https://doi.org/10.1111/ssqu.12270

Graziano, W. G., Habashi, M. M., & Woodcock, A. (2011). Exploring and measuring differences in person–thing orientations. *Personality and Individual Differences, 51*(1), 28-33. https://doi.org/10.1016/j.paid.2011.03.004

Graziano, W. G., Habashi, M. M., Evangelou, D., & Ngambeki, I. (2012). Orientations and motivations: Are you a "People person," a "Thing person," or both? *Motivation and Emotion, 36*(4), 465-477. https://doi.org/10.1007/s11031-011-9273-2

Gubbi, J., Buyya, R., Marusic, S., & Palaniswami, M. (2013). Internet of things (IOT): A Vision, architectural elements, and Future Directions. *Future Generation Computer Systems, 29*(7), 1645-1660. https://doi.org/10.1016/j.future.2013.01.010

Hargittai, E. (2002). Second-level digital divide: Differences in people's online skills. *First Monday, 7*(4). https://doi.org/10.5210/fm.v7i4.942

Hargittai, E., & Walejko, G. (2008). The Participation Divide: Content Creation and sharing in the digital AGE1. *Information, Communication & Society, 11*(2), 239-256. https://doi.org/10.1080/13691180801946150

Hwang, L.-A., Vaithilingam, S., Nair, M., & Ng, J. W. (2021). Nurturing academic enthusiasm and creativity among children from vulnerable communities: The Role of Computers. *Behaviour & Information Technology, 41*(12), 2596-2615. https://doi.org/10.1080/0144929x.2021.1938227

Ilesanmi, Oluwatoyin. (2009). *What is Cross-cultural Research? International Journal of Psychological Studies,1*(2),82. 10.5539/ijps.v1n2p82.

ITU. (2020). *Women, ICT and emergency telecommunications - opportunities and constraints*. ITU.

Ju, J., Liu, L., & Feng, Y. (2018). Citizen-Centered Big Data Analysis-Driven Governance Intelligence Framework for smart cities. *Telecommunications Policy, 42*(10), 881-896. https://doi.org/10.1016/j.telpol.2018.01.003

Jung, Y., Peng, W., Moran, M., Jin, S.-A. A., McLaughlin, M., Cody, M., Jordan-Marsh, M., Albright, J., & Silverstein, M. (2010). Low-income minority seniors' enrollment in a Cybercafé: Psychological barriers to crossing the digital divide. *Educational Gerontology, 36*(3), 193-212. https://doi.org/10.1080/03601270903183313

Kennedy, J., & Holcombe-James, I. (2022). "it's almost impossible to buy a dumb tv" experiences of automated decision-making and smart technologies in low-income homes. *Telematics and Informatics, 68*, 101767. https://doi.org/10.1016/j.tele.2021.101767

Khasawneh, O. Y. (2018). Technophobia: Examining its hidden factors and defining it. *Technology in Society. 54*, p. 93-100. DOI https://doi.org/10.1016/j.techsoc.2018.03.008

Klaib, A. F., Alsrehin, N. O., Melhem, W. Y., & Bashtawi, H. O. (2019). IOT smart home using eye tracking and voice interfaces for elderly and special needs people. *Journal of Communications*, 614-621. https://doi.org/10.12720/jcm.14.7.614-621

Kolotouchkina, O., Barroso, C. L., & Sánchez, J. L. (2022). Smart Cities, the digital divide, and people with disabilities. *Cities, 123*, 103613. https://doi.org/10.1016/j.cities.2022.103613

Kumar, A. K., & Sherkhane, M. S. (2018). Assessment of gadgets addiction and its impact on health among undergraduates. *International Journal Of Community Medicine And Public Health, 5*(8), 3624. https://doi.org/10.18203/2394-6040.ijcmph20183109

LG ThinQ. (2021). *LG Thinq - Think Wise. be free*. LG USA.

Livingstone, S., Ólafsson, K., Helsper, E. J., Lupiáñez-Villanueva, F., Veltri, G. A., & Folkvord, F. (2017). Maximizing opportunities and minimizing risks for children online: The role of digital skills in emerging strategies of parental mediation. *Journal of Communication, 67*(1), 82-105. https://doi.org/10.1111/jcom.12277

Mak, B., Nickerson, R. C., & Sim, J. (2018). Mobile Technology Dependence and mobile technostress. *International Journal of Innovation and Technology Management*, 15(04), 1850039. https://doi.org/10.1142/s0219877018500396

Martínez-Córcoles, M., Teichmann, M., & Murdvee, M. (2017). Assessing technophobia and technophilia: Development and validation of a questionnaire. *Technology in Society, 51*, 183-188. https://doi.org/10.1016/j.techsoc.2017.09.007

McDonough, C. C. (2016). The effect of ageism on the Digital Divide Among Older Adults. *Gerontology & Geriatric Medicine, 2*(1), 1-7. https://doi.org/10.24966/ggm-8662/100008

Mcknight, D. H., Carter, M., Thatcher, J. B., & Clay, P. F. (2011). Trust in a specific technology: An investigation of its components and measures. *ACM Transactions on management information systems (TMIS), 2*(2), 1-25.

McManus, J. F., & Carvalho, S. W. (2022). Consumers' love for technological gadgets is linked to personal growth. *Personality and Individual Differences, 194*, 111637. https://doi.org/10.1016/j.paid.2022.111637

Michler, O., Decker, R., & Stummer, C. (2019). To trust or not to trust Smart Consumer Products: A literature review of trust-building factors. *Management Review Quarterly, 70*(3), 391-420. https://doi.org/10.1007/s11301-019-00171-8

Millet, D. (2020). *Which countries are the most connected? and it is not who you might think*. DRF Consultants.

Mina, L. W. (2017). Chapter 14. Social Media in the FYC class: The New Digital Divide. Social Writing/Social Media: Publics, *Presentations, and Pedagogies*, 263-282. https://doi.org/10.37514/per-b.2017.0063.2.14

Moreno Mínguez, A. (2015). La empleabilidad de los jóvenes en España: Explicando El Elevado Desempleo juvenil Durante La Recesión Económica. *Revista Internacional De Investigación En Ciencias Sociales, 11*(1), 3-20. https://doi.org/10.18004/riics.2015.julio.3-20

Myhre, J. W., Mehl, M. R., & Glisky, E. L. (2017). Cognitive benefits of online social networking for healthy older adults. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences, 72*(5), 752-760. https://doi.org/10.1093/geronb/gbw025

Nicolaides, C. (2021). Mission possible - the mission on climate neutral and smart cities a new approach to sustainable urban transformation and urban transition to climate neutrality. *Renewable Energy and Sustainable Development, 7*(2), 41. https://doi.org/10.21622/resd.2021.07.2.041

Nikou, S. (2019). Factors driving the adoption of Smart Home Technology: An empirical assessment. *Telematics and Informatics, 45*, 101283. https://doi.org/10.1016/j.tele.2019.101283

Nimrod, G. (2018). Technophobia among older Internet users. *Educational Gerontology, 44*(2-3), 148-162. https://doi. org/10.1080/03601277.2018.1428145

Nimrod, G. (2021). Not good days for technophobes: Older internet users during the COVID-19 pandemic. *Educational Gerontology, 47*(4), 160-171.

Noori, N., Hoppe, T., & de Jong, M. (2020). Classifying pathways for Smart City Development: Comparing Design, governance and implementation in Amsterdam, Barcelona, Dubai, and Abu Dhabi. *Sustainability, 12*(10), 4030. https://doi.org/10.3390/su12104030

Osiceanu, M.-E. (2015). Psychological implications of modern technologies: "Technofobia" versus "technophilia." *Procedia - Social and Behavioral Sciences, 180*, 1137-1144. https://doi.org/10.1016/j.sbspro.2015.02.229

Prentice, D. A., & Carranza, E. (2002). What women and men should be, shouldn't be, are allowed to be, and don't have to be: The contents of prescriptive gender stereotypes. *Psychology of Women Quarterly, 26*(4), 269-281. https://doi.org/10.1111/1471-6402.t01-1-00066

Quan-Haase, A., Martin, K., & Schreurs, K. (2016). Interviews with digital seniors: ICT use in the context of everyday life. *Information Communication and Society, 19*(5), 691-707. https:// doi.org/10.1080/1369118X.2016.1140217.

Rodriguez, E. M. (2015, February 10). *Spanish society is the most connected to the internet in Europe*. Actualidad eCommerce

Rao, S. K., & Prasad, R. (2018). Impact of 5G Technologies on smart city implementation. *Wireless Personal Communications, 100*(1), 161-176. https://doi.org/10.1007/s11277-018-5618-4

Reddick, C. G., Enriquez, R., Harris, R. J., & Sharma, B. (2020). Determinants of Broadband Access and affordability: An analysis of a community survey on the digital divide. *Cities, 106*, 102904. https://doi.org/10.1016/j.cities.2020.102904

Rizk, J., & Davies, S. (2021). Can digital technology bridge the classroom engagement gap? findings from a qualitative study of K-8 classrooms in 10 Ontario School Boards. *Social Sciences, 10*(1), 12. https://doi.org/10.3390/socsci10010012

Rodden, T. A., Fischer, J. E., Pantidi, N., Bachour, K., & Moran, S. (2013). At home with agents. Proceedings of the SIGCHI *Conference on Human Factors in Computing Systems*. https://doi.org/10.1145/2470654.2466152

Rode, J. A., & Poole, E. S. (2018). Putting the gender back in Digital Housekeeping. *Proceedings of the 4th Conference on Gender & IT - GenderIT* '18. https://doi.org/10.1145/3196839.3196845

Sala, E., Gaia, A., & Cerati, G. (2020). The Gray Digital Divide in social networking site use in Europe: Results from a quantitative study. *Social Science Computer Review, 40*(2), 328-345. https://doi.org/10.1177/0894439320909507

Schauffel, N., Schmidt, I., Peiffer, H., & Ellwart, T. (2021). Self-concept related to information and communication technology: Scale Development and validation. *Computers in Human Behavior Reports, 4*, 100149. https://doi.org/10.1016/j.chbr.2021.100149

Schomakers, E.-M., Biermann, H., & Ziefle, M. (2021). Users' preferences for Smart Home Automation – investigating aspects of privacy and Trust. *Telematics and Informatics, 64*, 101689. https://doi.org/10.1016/j.tele.2021.101689

Scott, A. (2019). Small-scale enterprises and the environment in developing countries. *Small and Medium-Sized Enterprises and the Environment: Business Imperatives*, 275-288. https://doi.org/10.9774/gleaf.978-1909493-11-7_24

Selwyn, N. (2004). Reconsidering political and popular understandings of the digital divide. *New Media & Society, 6*(3), 341-362. https://doi.org/10.1177/1461444804042519

Shu, Q., Tu, Q., & Wang, K. (2011). The impact of computer self-efficacy and technology dependence on computer-related technostress: A Social Cognitive Theory Perspective. *International Journal* of *Human-Computer Interaction, 27*(10), 923-939. https://doi.org/10.1080/10447318.2011.555313

Shuhaiber, A., & Mashal, I. (2019). Understanding users' acceptance of smart homes. *Technology in Society, 58*, 101110. https://doi.org/10.1016/j.techsoc.2019.01.003

Smith, A. (2020, May 30). *Older adults and technology use*. Pew Research Center: Internet, Science & Tech.

Sobieraj, S., & Krämer, N. C. (2020). Similarities and differences between genders in the usage of computer with different levels of technological complexity. *Computers in Human Behavior, 104*, 106145. https://doi.org/10.1016/j.chb.2019.09.021

Sovacool, B. K., & Furszyfer Del Rio, D. D. (2020). Smart Home Technologies in Europe: A critical review of concepts, benefits, risks and policies. *Renewable and Sustainable Energy Reviews, 120*, 109663. https://doi.org/10.1016/j.rser.2019.109663

Strengers, Y. (2021). Smart wife: Why Siri, Alexa, and other smart home devices need a feminist reboot. *MIT PRESS*.

Strengers, Y., & Nicholls, L. (2017). Aesthetic pleasures and gendered tech-work in the 21st-century smart home. *Media International Australia, 166*(1), 70-80. https://doi.org/10.1177/1329878x17737661

Strengers, Y., Kennedy, J., Arcari, P., Nicholls, L., & Gregg, M. (2019). Protection, productivity and pleasure in the smart home. Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems. https://doi.org/10.1145/3290605.3300875

Su, R., Rounds, J., & Armstrong, P. I. (2009). Men and things, women and people: A meta-analysis of sex differences in interests. *Psychological Bulletin, 135*(6), 859-884. https://doi.org/10.1037/a0017364

Sun, N., & Botev, J. (2021). Intelligent Autonomous Agents and trust in virtual reality. *Computers in Human Behavior Reports, 4*, 100146. https://doi.org/10.1016/j.chbr.2021.100146

Tekinarslan, E. (2008). Computer anxiety: A cross-cultural comparative study of Dutch and Turkish university students. *Computers in Human Behavior, 24*, 1572-1584.

Tolentino, M. (2016, April 27). Southern men are most likely to own Smart Home Tech: Report. SiliconANGLE.

Tramontano, C., Grant, C., & Clarke, C. (2021). Development and validation of the e-work self-efficacy scale to assess digital competencies in remote working. *Computers in Human Behavior Reports, 4*, 100129. https://doi.org/10.1016/j.chbr.2021.100129

Van Deursen, A. J. A. M., Helsper, E. J., & Eynon, R. (2014). *Measuring Digital Skills. From Digital Skills to Tangible Outcomes project report.* Oxford Internet Institute Projects.

Van Dijk, J. A. (2005). Inequality in the information society. *The Deepening Divide: Inequality in the Infor-*

mation Society, 131-144. https://doi.org/10.4135/9781452229812.n7

Venkatesh, V., & Morris, M. G. (2000). Why don't men ever stop to ask for directions? gender, social influence, and their role in technology acceptance and usage behavior. *MIS Quarterly, 24*(1), 115. https://doi.org/10.2307/3250981

Wallsten, S. (2013). What are we not doing when we're online. National Bureau of Economic Research. https://doi.org/10.3386/w19549

Wang, A. B. (2018, December 20). *'I'm in your baby's room': A hacker took over a baby monitor and broadcast threats*, parents say. The Washington Post.

Wang, X., Shi, J., & Lee, K. M. (2022). The digital divide and seeking health information on smartphones in Asia: Survey study of ten countries. *Journal of Medical Internet Research, 24*(1). https://doi.org/10.2196/24086

West, M., Kraut, R., & Ei Chew, H. (2019). I'd blush if I could : closing gender divides in digital skills through education. *Ministerio De Educación, 306*, 1-146.

White, R. (2018). Changes to the leisure time landscape and its impact on out-of-home entertainment and arts. White Hutchinson Leisure & Learning Group.

Wild, K. V., Mattek, N. C., Maxwell, S. A., Dodge, H. H., Jimison, H. B., & Kaye, J. A. (2012). Computer-related self-efficacy and anxiety in older adults with and without mild cognitive impairment. *Alzheimer's & Dementia, 8*(6), 544-552. https://doi.org/10.1016/j.jalz.2011.12.008

Wilson, C., Hargreaves, T., Hauxwell-Baldwin, R. (2017) Benefits and risks of smart home technologies. *Energy Policy 103*:72-83.

Woodcock, A., Graziano, W. G., Branch, S. E., Ngambeki, I., & Evangelou, D. (2012). Engineering students' beliefs about research: Sex differences, personality, and career plans. *Journal of Engineering Education, 101*(3), 495-511. https://doi.org/10.1002/j.2168-9830.2012.tb00059.x

Woollaston, V. (2014, July 17). *The most tech addicted country in Europe? Spain: Spanish use devices almost 9 hours a day outside of work*. Daily Mail Online.

Yang, H., Lee, H., & Zo, H. (2017). User acceptance of smart home services: An extension of the theory of planned behavior. *Industrial Management & Data Systems, 117*(1), 68-89. https://doi.org/10.1108/imds-01-2016-0017

Zhuravlev, A. L., & Nestik, T. A. (2016). Psychological aspects of negative attitudes toward new technologies. *Psikhologicheskii zhurnal, 37*(6), 5-14.