Live Smart: A cross-cultural investigation of smart home technology acceptance and the role of digital competence, needs frustration, technophobia and technophilia

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UNIVERSITAT RAMON LLULL

DOCTORAL THESIS

Title	Live Smart: A cross-cultural investigation of smart home technoloy acceptance and the role of digital competence, needs frustration, technophobia and technophilia
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1.0. Rationale and summary

Over the last twenty years, concepts such as the smart home, Internet of things (IoT), and smart home technology have been slowly creeping into the consciousness of society. Until recently, research on smart technology has been somewhat ad hoc, and very few papers have used psychological theory to evaluate smart home devices. Therefore, this doctoral thesis aims to deepen the understanding of the psychological relationship between humans and smart home technology.

The research available on smart home technology (SHT) dissects varied topics within the smart paradigm, including a panoptic smart future (Kitchin, 2013), smart home benefits and risks (Sovacool & Furszyfer Del Rio, 2020), challenges and solutions (Risteska Stojkoska & Trivodaliev, 2017) algorithms and deep learning (Dai et al., 2019) and attitudes towards smart technology (Edison & Geissler, 2003). Very few papers have explained the use of SHT with psychological theories (Kim et al., 2020). The present research addresses the lack of theory in previous literature and builds on the work of Khasawneh (2018), which suggests more research needs to be done on smart devices in general (Martínez-Córcoles et al., 2017) rather than on a specific product. By evaluating the acceptance of smart devices using established psychological theories, this project adds new data within the arena of human-to-computer interaction (HCI) and consumer psychology. In line with consumer psychology protocols, this research examines how implicit beliefs and conditions, both psychological and behavioral, can impact consumption-oriented processes and outcomes (Jain & Weiten, 2019). The project also examines the effects of gender, age, and cross-cultural aspects of smart home use. The results could aid technology manufacturers to consider their customers' needs during the development process and possibly influence social policy by learning how to incorporate the older generations and more females into the smart technology eco-system.

The present doctoral thesis consists of two studies: Study 1 uses the theory of technological acceptance, (TAM), a proven model for SHT acceptance and adds self-determination theory (SDT) as a model to assess psychological needs (in this case, frustration of the needs of autonomy, relatedness, and competence); the role of technophobia is investigated in this context. A sample of English (N = 284) and Spanish (N= 230) SHT users replied to a series of questionnaires assessing acceptance of SHT, frustration of psychological needs, technophobia and their intention to use SHT. A mediation model was established that predicted that perceived usefulness, perceived ease of use, and technophobia would mediate the effect of the frustration of psychological needs (autonomy, relatedness, and competence) on behavioural intention to use SHT. Technophobia did not act as a mediator, as there was no direct effect of need frustration on behavioural intention; however, technophobia proved significant as a stand-alone predictor of intention to use smart home products. There were no significant gender effects, but there were important differences between the English and Spanish participants, which are discussed in terms of cultural differences in the degree to which need frustration is essential for participants.

Study 2 uses a sample of 243 participants aged 18-65 to explore the roles of technophobia, technophilia, trust in technology and digital competence within the SHT paradigm. The results showed that technophobia correlated positively with age and negatively with ownership and most digital skills. Operational and creative digital skills were key factors in in this context. Technophilia turned out to be a complex construct that was not the antithesis of technophobia as it incorporated technophobic elements. Males outscored females in overall digital competence and especially in creative skills and technophilia. Spanish participants scored higher than the English participants on operational digital skills, creative digital skills, and technophilia-dependency. A hierarchical regression model with technophobia as the dependent variable showed that the operational and mobile digital skills

contributed negatively to technophobia, whereas navigational digital skills did so positively. Technophilia-enthusiasm predicted technophobia negatively, whereas technophilia-reputation did so positively. Culture and gender were not significant in predicting technophobia in this context.

The present research showed that psychological and behavioural barriers like technophobia, perceived ease of use (PEU) and perceived usefulness (PU) can impact individuals' acceptance of SHT. Moreover, the novel discovery that PEU significantly mediated with technophobia indicates that within consumer psychology individuals prefer uncomplicated SHT to fulfil their individual needs. They want to carry out domestic chores using SHT with the least effort possible. Manufacturers should consider simplifying their products for wider appeal and custom design products for different consumer groups as cultures prefer to maintain a degree of control over their domestic robots whereas others do not.

Study two demonstrated that technophilia and technophobia are not direct opposites as technophilia has positive and negative attributes which can cause technophobic outcomes. Moreover, the importance of acquiring digital skills to avoid technology anxiety and navigate successfully within the modern world permeates throughout the research. Ownership of smart devices, which helps individuals become accustomed to SHT, is one route to gaining the digital skills needed to gain technological confidence which goes some way to lessening any anxiety or technophobia towards SHT.

I. THEORETICAL SECTION

1.1. Smart Home Technology (SHT)

The invention of the home computer and WIFI were two crucial discoveries that led to the technology-based world we now experience. Digital technology is an integral component of the world's population and significantly influences societal interaction; it has created cultural shifts and affects individuals' day-to-day existence. Technology increasingly mediates how we shop, book holidays, or do household chores. Furthermore, the human experience is confronted with the advancement of an information and communication technology (ICT) revolution based on The Internet of Things (IoT), which allows individuals to connect to multiple smart devices and exchange data and information anywhere at any time.

IoT is defined as the intercommunication between actuating devices using sensors allowing them to exchange information and data via a Cloud based unified framework (Gubbi et al., 2013). In other words, our everyday sensor-based home devices can communicate autonomously or via a remote hub such as a smartphone or a voice-control platform like Alexa and Google Assistant. Sensors, monitors, interfaces, appliances, and SHT devices are networked within the domestic environment (Cook, 2012). Based on the IoT ecosystem, the smart home contains intelligent devices, including smart meters, smart TV, smart locks, CCTV, and wearables. Smart grids drive machine-to-machine communication (M2M) using concepts like pervasive or ubiquitous computing (Greenfield & Yan, 2006) and 5th generation (5G) telecommunications broadband and blockchain systems.

There are two perspectives on how a home is understood and portrayed as 'smart'. On the one hand, a smart home allows homeowners to use innovative technology to control household appliances remotely and independently like lighting, temperature, security alarms, surveillance cameras and other connected devices. Additionally , the smart home offers

services tailored to the needs of individual homeowners (Balta-Ozkan et al., 2013). Similarly, Darby, (2017) notes two broad categories, one being "building and system-focused" and the other "home- and user-focused". Mennicken et al. (2014) distinguish between remote access technologies with no automation and those that are responsive to their inhabitants and adapt autonomously in sophisticated ways. Thanks to intelligent power scheduling algorithms (Risteska Stojkoska & Trivodaliev, 2017), the smart home user has control over certain appliances, like energy consumption devices. In contrast, other home features, such as lighting and windows, are automated and do not require human interaction.

For example, a switch light can automatically turn on when one enters a room. However, the homeowner can also make a priori choices and interconnect directly to a smart meter to lower energy consumption manually. Gubbi et al. (2013) believe that such advances in home technology, promise high reliability, scalability, and autonomy. Every time a household appliance acts, the data will be stored and processed in an advanced cloud framework (Lihong Jiang et al., 2014; Lee et al., 2015). The cloud-centric approach allows a third party to access the smart home's stored data and relay effective solutions directly to the consumer via the smartphone or smart internet-based smart hub (Fan et al., 2017). Based on the cloud data, an energy company could send a homeowner weekly analytics or advice on consuming less energy. Thus, the device is viewed as smart as it provides the consumer with invaluable information which could aid in controlling everyday household consumption.

However, with most technology, there are some downsides. Due to privacy issues, the Dutch government curbed plans for a compulsory rollout of smart meters as part of a national energy reduction plan (McLaughlin et al., 2010). Therefore, although smart devices provide the consumer with convenient money and energy-saving information, internet cloud-based architecture poses security and privacy risks to the individual. The risk-benefit conundrum has been extensively investigated by examining the various models used in the existing

literature by researchers looking to understand why individuals accept or reject SHT (Li et al., 2021).

A more comprehensive choice of home-based technology options has recently increased time spent at home (White, 2018). Likewise, research on individuals' use and acceptance of SHT is relevant as 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. From 2008 to 2016, time spent on technology increased twofold (Clark, 2019), and in 2017, people spent almost a third of their day using a technology-based device (Adobe Follow, 2018). As smart concepts such as virtual and augmented reality become more ubiquitous, home time will increase, and out-of-home leisure activities will decrease (White, 2018).Additionally, the Covid-19 pandemic increased considerably our time using smart devices at home, eroding our privacy and security as we were remotely forced to let teachers, students, employers, and authorities into our personal dwelling space (Maalsen & Dowling, 2020).

The Smart Home is thus becoming a reality, and judging from sales forecasts, more people are adopting heterogeneous smart appliances into the home environment. The smart technology industry is full of optimism because of the capability of smart technology to connect to an end-user or other machines via IoT. As a result, smart technology will allow more people to use devices easily, providing a high degree of comfort and convenience (Balta-Ozkan et al., 2013); thus, smart technology is set to play a significant role in advancing the relationship between humans and machines. However, the optimism of global adoption within the smart industry may be somewhat overestimated as the industry is still at an early stage and has not been wholeheartedly accepted by the world population (Greenough, 2016). For instance, Smart home technology (SHT) products are widely

available but have not been integrated into everyday life for various reasons. Actual sales and forecasting future sales trends are valuable barometers of diffusion, popularity, and, thus, a reflection of acceptance of SHT. However, in the case of SHT, differing global sales totals for the same year were presented, which indicates discrepancies in the literature and questions the popularity and diffusion of SHT (Aldossari & Sidorova, 2018; Hong et al., 2020; Hubert et al., 2019; Liu & Chou, 2020; Schill et al., 2019; Sequeiros et al., 2021; Van Hung et al., 2021; Yang et al., 2018).

The lack of global acceptance could be due to external causes such as design fallibilities or incompatibility between devices are cited as other possible reasons for low SHT acceptance (Nikou, 2019; Park & Cho et al., 2017; Van Hung et al., 2021; Wang et al., 2018). Marketing and advertising within the SHT sector could also contribute to low SHT acceptance as people are still unaware of terms such as the smart home or IoT (Cannizzaro et al., 2020). However, there might be psychological factors such as technophobia, anxiety or trust issues that have not been fully studied.

1.2. Models used to investigate SHT acceptance

Although research on SHT acceptance is still in its infancy, the investigation of the use and acceptance of technology in general has been studied extensively since its genesis (Venkatesh et al., 2007). The technology acceptance model (TAM) created by Davis (1989) is frequently used across the broad topic of technology acceptance. TAM professes that if a person finds technology easy to use and useful, there is more probability of accepting and using the technology. The TAM centres on the user experience rather than the features of a specific product. The versatility of the model is evident as it has been used in various technological scenarios, including Mobile learning and assessment (Nikou & Economides, 2017), wearable devices (Chuah et al., 2016) and mobile phone usage (Zheng, 2020),

intelligent tourism (Venkatesh & Davis, 2000). Park & Kim et al., (2017) justify their use of the TAM by citing previous authors (Gao & Bai, 2014) who highlighted the effectiveness of its two main factors, perceived ease of use (PEU) and perceived usefulness (PU). The motivation to use TAM is that it is simple, supported by a wide range of existing literature (Liu & Chou, 2020) and was developed to directly tackle why people reject or accept technology (Durodolu, 2016). Researchers also use TAM because it is a robust and valid theory yet is a cheap and fast way to accrue data on people's perceptions of technology acceptance (Legris et al., 2003).

The first model to examine the acceptance of technology was the theory of reasoned action (TRA) created by Fishbein and Ajzen, (1977). The model focuses on behavioural intentions and states that if individuals benefit from technology, they are more likely to accept and use the products (Samaradiwakara & Gunawardene, 2014). However, the TRA is not widely used in contemporary literature on SHT acceptance, possibly because there is a risk of confusing its independent variables, attitude, and social norms (Nickerson, 2022; Sheppard et al., 1988) However, its contribution to the overall discussion should not be underestimated. It is the predecessor for multiple theories and models used by SHT researchers, such as TAM, the theory of planned behaviour (TPB) and the unified theory of acceptance and use of technology (UTUAT).

The theory of planned behaviour (TPB) has also been used in SHT acceptance literature partly due to its direct relationship with behavioural intention to actually use the corresponding technology (Yang et al., 2017). TPB extends from TRA by incorporating perceived behavioural control (PBC) which defines the extent to which an individual believes they can control the outcome of an event. The theory posits that attitude towards behaviour, subjective norms, and perceived behavioural control are functions that act as antecedents to behavioural intention to use (BI) and actual behaviour (Mital et al., 2018). Mital et al. (2018)

buttress their use of using TPB in SHT acceptance research by referencing its flexibility in differing research settings from e-coupons (Kang et al., 2006) to mobile commerce (Pedersen, 2005). TPB can report precise predictions (Mathieson, 1991; Mital et al., 2018) yet has several limitations such as assuming an individual has the possibility and resources to be successful in performing the desired behaviour, regardless of the intention (LaMorte, 2022).TAM and TPB both identify intentions to use technology equally, yet TAM is easier to apply.

The unified theory of acceptance and use of technology (UTAUT) is another popular model used in SHT acceptance research. Developed by Venkatesh et al. (2003), UTUAT was created because the authors believed too many different models were being used to study technology acceptance and wanted a centralized and unified model encompassing various models in one model. Furthermore, Venkatesh et al. (2003) wanted to aid researchers who were forced to "pick and choose" variables across the models or select their favourite model and disregard the benefits of alternative models. In the UTUAT, the four key variables that influence behavioural intention to use technology are:

1) Performance expectancy-The degree of benefits when using technology

2) Effort expectancy-Level of ease consumers associate when using technology.

3) Social Influence- The degree of importance the opinion of others, such as family and friends, have when deciding to use technology.

4) Facilitating conditions-The degree of support and aftercare afforded to consumers after purchasing technology.

The variables, age, gender, and experience are used to moderate the various relationships in UTUAT. An updated version, UTUAT2, was developed and incorporated extra variables such as price/cost to investigate consumer habits and technology acceptance. However, UTUAT has come under some criticism due to the vast number of variables used

and the variables have invariant true scores across most but not all subgroups (Li & Kishore, 2006).

The value-based adoption model (VAM) is a consumer-based model (Kim et al., 2007) which borrows usefulness from the TAM alongside exogenous cost-benefit variables, including enjoyment, perceived fee, and perceived value. Although a relatively new theoretical model, the VAM was used to investigate the acceptance of mobile internet usage (Kim et al., 2007), self-customization service (Yu et al., 2019) and the smart home (Hubert et al., 2019; Kim et al., 2017). Cost-benefit has been used within the existing literature to gauge individuals' acceptance of SHT. It had been used in various models like VAM (Kim et al., 2017; Shuhaiber & Mashal, 2019; Sohn & Kwon, 2020) and UTUAT (Sequeiros et al., 2021) or attached to other models, such as the TAM (Shuhaiber et al., 2019). Cost-benefit may be a hindrance when deciding to accept new technology. Even spending money on an economically priced product could be costly in the long term, and expensive products may push many prospective consumers out of the market. Thus, cost-benefit refers not only to price but to the individual's prior contemplation of the benefits and disadvantages in line with the price of a smart device (Park & Hwang et al., 2017). Cost -benefit includes the device's installation, maintenance, and operation (Shin, 2009). Cost was mentioned as barriers to smart home technology adoption in various articles (Mital et al., 2018; Nikou, 2019; Shuhaiber et al., 2019; Sohn & Kwon, 2020; Van Hung et al., 2021).

As stated by Venkatesh et al. (2003), many models were used to investigate technology and SHT acceptance before the creation of UTUAT. Innovation resistance theory (Ram, 1987), updated two years later by Ram and Sheth, (1989), examines why consumers resist new technology and innovation such as SHT. It is based on the premise that new technology will bring about changes in the status quo that will cause concern for individuals who are cautious of any divergence from their current belief system (Hew et al., 2019).

Innovation resistance theory (IRT) presents functional and psychological constructs as barriers to accepting technology. The functional barriers include value, risk, and usage, while the psychological barrier is divided into image and tradition. The model has been used to measure low adoption rates in various fields (Sadiq et al., 2021), including SHT (Hong et al., 2020; Kim et al., 2017; Pal et al., 2021). In contrast, the diffusion of innovation theory (DOI) explores how new technology spreads throughout society by firstly being accepted and adopted by innovators and early adopters (technophiles) and, over time spreading throughout society (Rogers, 2003). According to the theoretical model, four factors impact the adoption and acceptance of new innovative technology:

- The technology itself
- Communication methods and outlets used to market and advertise the technology
- Time
- The type and nature of a society
- The target audience.

The framework has been used in to explain acceptance in various technological sectors, including the smartphone (Chen et al., 2009), smart energy (Perri et al., 2020) and the smart home (Hubert et al., 2019; Nikou, 2019). Other less popular models used to examine SHT acceptance and intention to use (Pal et al., 2021) include the privacy based multidimensional development theory (Laufer & Wolfe, 1977), the technology task fit model (Goodhue & Thompson, 1995) and the technology readiness index (Parasuraman, 2000). A summary of the leading models used for SHT acceptance is outlined in table 1.1

Table 1.1.

Models used to assess SHT acceptance

Model and Author	Description	Advantages	Disadvantages
The Technology Acceptance Model (TAM) Davis (1989)	Understanding the cognitive processes within users and how they will adopt and integrate into a new piece of technology.	1) Numerous empirical studies have found that TAM consistently explains a substantial proportion of the variance in usage intentions and behaviours with a variety of information technologies. 3) TAM is a robust, powerful, and parsimonious model for predicting user acceptance of information technologies. 4) Proven to be of quality and statistically reliable.	1) Ignores some important theoretical constructs 2) TAM does not reflect the variety of user task environments and constraints
The Theory of Reasoned Action (TRA) Fishbein and Ajzen (1975)	Based on volition, it predicts if people can produce certain behaviours when desired to do so.	1) Powerful predictive power of consumer‘s behavioural intention verified with a wide variety of consumer products. 2) A well-researched theory designed to explain virtually any human behaviour.	1) Consumers do not have complete control over their behaviour in some conditions. 2) The direct effect of subjective norms on behavioural intention is difficult to isolate from the indirect effects of attitudes. 3) Did not include personality characteristics, demographic or social roles that influence behaviours.
Unified theory of acceptance and use of technology (UTUAT) Venkatesh et al. (2003)	A blend of models using four factors and four moderators used to predict intention to use technology.	1) Multi variable model testing many outcomes. 2) Covers social and psychological factors.	1) Inconsistencies in explanatory ability. 2) Too general in terms of incorporating classes of technologies
The Theory of planned Behaviour (TPB) Ajzen (1985)	Understand and predict human behaviour which is predicated on intention, willpower, and effort	1) A broader model compared to TRA 2) The theory has received substantial empirical support for predicting behaviour in information systems and other domains	1) Constructs are difficult to define and measure in a study. 2) The model suffers from multicollinearity among the independent variables.
Innovation Resistance Theory (IRT) Ram (1987)	Maintain the current state and not adopt the innovation when faced with the pressure to change from the current state.	1) Pinpoints individuals’ reasons for technological rejection.	1) Non versatile and limited in its use
Value-based Adoption Model (VAM) Kim et al., (2007)	Centred on a cost–benefit paradigm depicts the decision-making process in which the cost of uncertainty in selecting a new technology is compared.	1) Created to investigate technology acceptance 2) Consumer focused on cost benefit paradigm	1) Narrow and specific 2) Little empirical data supporting the model

In the final assessment, the TAM will be used in study 1 to investigate individual’s acceptance of SHT because:

- It was developed specifically for the purpose of technology acceptance (Davis, 1989).

- TAM adopts straightforward assumptions when interpreting data.
- It is a robust yet parsimonious model and useful when investigating a particular information system like SHT.
- The model serves to comprehend and clarify use behaviour in information system implementation.
- TAM has been incorporated into a great many empirical studies and yielded statistically sound results (Aldossari & Sidorova, 2018; Hong et al., 2020; Hubert et al., 2019; Liu & Chou, 2020; Schill et al., 2019; Sequeiros et al., 2021; Van Hung et al., 2021; Yang et al., 2018).
- TAM predicts IT acceptance under different conditions, such as time and culture, with different control factors (Olushola & Abiola, 2017).
- TAM has been employed in different contexts to explain technology adoption and acceptance. Its structure has proven to be of quality and highly reliable (Legris et al., 2003).

1.3. The TAM model: components and empirical findings

The evidence shows that the TAM is a useful model used to investigate SHT acceptance due to the constructs incorporated into the model: perceived usefulness and perceived ease of use (Aldossari & Sidorova, 2018; Hong et al., 2020; Hubert et al., 2019; Liu & Chou, 2020; Schill et al., 2019; Sequeiros et al., 2021; Van Hung et al., 2021; Yang et al., 2018). Perceived usefulness (PU) is defined as an individual's perception that using new technology will enhance or improve her/his performance (Davis, 1993). Developed initially to assess goal-orientated performance and adoption of computers in a working environment (Davis, 1989), perceived usefulness plays a highly significant role in the acceptance and intention to use SHT technology. The construct has been extensively evaluated in various scenarios dedicated to technology acceptance such as e-government services (Chen & Aklikokou, 2020) and digital consumerism (Moslehpour et al., 2018). Perceived usefulness

within the smart home literature reflects SHT manufacturers objectives which is to improve the quality of life within the home, through convenience and comfort (Balta-Ozkan et al., 2013). If these improvements to home living are satisfied, then the SHT is deemed useful.

According to Gimpel et al. (2020), PU is the most significant variable for measuring SHT acceptance. The authors found performance expectancy, an underly construct of PU (Venkatesh et al., 2003), as a highly significant determinant of smart technology acceptance. Furthermore, it is a flexible construct that relates not only to intention to use but also to independent variables such as compatibility (Van Hung et al., 2021), economic benefit, or trialability (Nikou, 2019). PU positively affects intention to use (Shuhaiber & Mashal, 2019) and thus reinforces this study's accretion of TAM's importance in SHT acceptance literature. In the context of providing users with vital information regarding utility usage (energy consumption) or personal details (hours watching smart T.V.), PU is seen as vital for continuous acceptance and long-term usage (Gomez et al., 2019).

Another variable of the TAM with high significance on intention to use SHT is perceived ease of use (PEU). PEU is identified as the degree to which a person believes that technology will be free from effort (Davis, 1989). Studies have shown that a refusal to accept SHT is partly due to the complexity of smart home devices and lack of ease of use (Alsulami & Atkins, 2016; Balta-Ozkan et al., 2013). PEU showed to be a significant factor during the acceptance process of SHT (Park& Cho et al., 2017; Van Hung et al., 2021).

PEU also affected behavioural intention to use (BI) via two causal pathways: (1) a direct effect (PEU-BI) (Sohn & Kwon, 2020) and (2) an indirect effect via PU (PU-PEU-BI) (Marikyan et al., 2021). It is noted that ease of use can ensure long-term acceptance if the smart device or devices work with little complexity or effort by using a simple user interface (U.I.). In addition, SHT acceptance is more probable if it does not disrupt an individual's lifestyle within the home by adapting to the end users' needs via easily transferable implicit

and explicit feedback (Gomez et al., 2019). As a result, PEU can create a sense of end-user satisfaction, increasing acceptance and usage, especially if individuals feel they can efficiently complete an action (Al-rahmi et al., 2017).

1.4. Variables that influence (smart home) technology acceptance

1.4.1. *Technophobia*

Literature outlining the possibility of humans rejecting technology began to surface over fifty years when the phrase technophobia was first coined by Paschen and Gresser (1974). Various researchers have defined technophobia (Brosnan, 1998; Hogan, 2008), of which certain common denominators, such as computer anxiety, negative attitudes to technology and technology-based stress. Other factors that encapsulate technophobia include specific phobias such as cultural, environmental, and genetic factors (Maj et al., 2004). Although complex to define, technophobia is associated with specific factors like anxiety, nervousness, stress, and negative attitudes (Hogan, 2008). Khasawneh et al. (2020) definition includes irrational fear, which forces people to change their behaviour when confronted with technology. Such changes in behaviour may include using technology minimally or not at all, which could fuel the digital divide (Dahl & Bergmark, 2020). Indeed, fear of technology is not uncommon and was America's second most feared phenomenon after natural disasters (Bader et al., 2017).

The scientific literature on individuals rejecting technology for psychological reasons is still scarce, and there is even less literature specific to the relationship between SHT acceptance and technophobia (Daruwala & Oberst, 2022). Existing scientific literature focuses on the evolution of new technology rather than examining its behavioural and psychological consequences on end-users (Martínez-Córcoles et al., 2017). However, technology is now an integral part of the human experience, and technophobia has been

examined within different contexts, including the workplace (Khasawneh et al., 2020), vehicle autonomy (Hudson et al., 2019), education (Rouf et al., 2022), sports wearables (Cavdar Aksoy et al., 2020), food production (Perito et al., 2019) and internet usage (Nimrod, 2021). The literature examining smart home usage and technophobia is generally limited to e-health for the elderly (Wang & Chen, 2015). Lack of trust in smart and interactive technology, which can lead to technophobia, has been an issue, especially with the older generations (Lee & Maher, 2021; Nimrod, 2021; Sponselee et al., 2007). Low education levels may also lead to technophobia (Wang & Chen, 2015).

Recent studies have also highlighted the negative psychological impact of technology on humans, which can lead to isolation (Primack et al., 2017), depression (Twenge et al., 2018), and suicide (American Psychological Association, 2019). Therefore, the interaction between humans and technology can cause negative outcomes, especially if technology use is mandatory (Agogo & Hess, 2018). Moreover, the paradox for people with technophobia is that the same technology that makes life easier by incorporating more features into each device also makes life more difficult by making the device more difficult to learn and use (Norman, 2021). According to the theories such as the TAM (Davis, 1989) and the UTUAT (Venkatesh et al., 2003), if technology takes an excessive amount of effort or is not easy to use, then it is feasible that the technology will not be accepted, especially if the individual feels insecure around technology. Therefore, not accepting technology could be a symptom of technophobia (Ossman et al., 2006).

The use of the technophobia construct is justified as 30% of the world's population is considered to be affected by it (Koul & Eydgahi, 2019; Subero-Navarro et al., 2022). Technophobia is even viewed as a pathology that should be medically treated (Thorpe & Brosnan, 2007). In any case, the relationship between technophobia and acceptance of SHT is still under-researched (Nimrod, 2018). Gaining a better understanding of how technophobia

affects an individual's acceptance of SHT could assist marketers, smart manufacturers, and government policymakers develop successful programmes (Gilly et al., 2012) also for psychologist to help people deal with their technophobia.

Khasawneh's (2018) has developed an accredited and up to date scale to measure technophobia. It is a general and flexible scale that can be used for various technologies including SHT. It is also a comprehensive scale which covers the fundamental aspects of technophobia including fear, paranoia, anxiety, and avoidance. Other scales are available, yet they focus on a specific technology, mainly computers (Lester, 2005), they provide a poor explanation of the data. (Gordon et al., 2003) or created decades ago and thus outdated (Simsek, 2011).

1.4.2. *Technophilia*

Technophilia is defined as a love or desire for innovative technology coupled with a great deal of enthusiasm (Martínez-Córcoles et al., 2017).To date it has not been used to assess SHT acceptance yet similar studies on other technologies are available. A study on IoT which incorporate SHT highlighted that technophilia and digital skills have a interlinked relationship. The technological enthusiast is eager to improve their digital skills and people with digital skills are more enthusiastic as they have good commando over technology (Jahan et al., 2021). Technophilia proved to have a positive correlation with e-cigarette trials yet due to external factors like price, was not significant when measuring continued use (Barrientos-Gutierrez et al., 2019). A study comparing levels of technophilia between sufferers of mild cognitive impairment and their caregivers concluded that technophilia was associated with lower age, male gender, higher educational level, lower depression, and better health status (Guzman-Parra et al., 2020).The authors used the construct TechEnthusiasm which is analogous to the construct, tecnophilia-enthusiasm, used in this

paper (Martínez-Córcoles et al., 2017). According to Martínez-Córcoles et al., technophilia consists of three related constructs:

- Tecnophilia-enthusiasm – A positive attitude and strong attraction to innovative technology.
- Technophilia-reputation- Delight and joy in at possessing the latest technology product which enhances one's reputation yet has latent negative overtones.
- Technophilia-dependency - Dependence on technology, which has possible severe outcomes such as anxiety, stress, and technophobia, especially if technology is not close at hand.

1.4.3. *Psychological needs*

Self-determination theory (SDT) assumes that there are three basic psychological needs: autonomy, competence, and relatedness. The theory states that the satisfaction of these needs improves an individual's psychological growth, social integration, and well-being (Deci & Ryan, 2002). In contrast, frustration of these needs leads to feelings of ill-being and distress (Ryan & Deci, 2017). SDT is based on decades of research (Ryan & Deci, 2017; Vansteenkiste & Ryan, 2013) that validate the three factors as the most prognostic and dependable mediators of motivation, engagement, and well-being (Peters et al., 2018), especially if individuals engage in tasks of interest.

Relatedness. In essence, relatedness refers to the feeling of connectedness or connection with others through interaction which creates a sense of belonging and enjoyment (Khan et al., 2017; Niemiec & Ryan, 2009; Nikou & Economides, 2017; Ryan & Deci, 2000). Feelings of relational exclusion and loneliness cause relatedness frustration. Indeed, in the ambit of technology, people may feel lonely even if connected to others via technology due to the absence of personal physical interactions. The same feeling could also be applied to SHT

because home technology usage is generally an individual experience and, until now, does not promote or consider any social interactions.

However, ownership of SHT may offer a sense of belonging to the modern technology-based society. Moreover, the products could provide a source of interaction and conversation with other SHT users or be used to connect digitally with other users. Additionally, SHT communities are being created by end-users to share their experiences (Ruiz, 2020). A recent study in a living lab environment concluded that participants preferred to connect with other users when looking for advice on SHT usage rather than going through training manuals (Wright et al., 2021). Apart from the personification of voice controllers like Amazons Alexa (Lopatovska & Williams, 2018), SHT is also being used as toys for people's entertainment, increasing the sense of relatedness (Trajkova & Martin-Hammond, 2020), which motivates usage. Indeed, the gamification of SHT through domestic task competition between families and competing households will only add to the enjoyment of SHT and avoid needs frustration (Winnicka et al., 2019).

Autonomy. The feeling of agency, control over one's actions and the experience of volition when carrying out an activity best define autonomy (Chen et al., 2014; Yoon & Rolland, 2012). Regarding the smart home, autonomous behaviour reflects the self and individual's choices on when and how to interact with SHT. Autonomy, or lack of it, was seen as a barrier to technology acceptance for the elderly who need smart assistance at home (Di Giacomo et al., 2019; Garçon et al., 2016).

Autonomy frustration may arise if home dwellers feel that SHT controls them through externally enforced or self-imposed pressures (Chen et al., 2014). People may become frustrated by constant reminders by SHT to complete an action, intrusive automation behaviour, the need for updates or devices breaking down. Autonomy frustration concerns the wider population as a UK survey with over 1000 participants concluded that the loss of

autonomy and independence were perceived more strongly than the privacy and data security concerns (Wilson et al., 2017). The individual should decide when to interact with SHT and not the other way around. SHT is practical and with little nuance. Although in the future, SHT will more than likely take more of a leading role within the home environment, especially if equipped with artificial intelligence, it is still the human who takes the decisions. As a result, we expect autonomy to positively and significantly influence behavioural intention to use SHT.

Competence. To be competent is to believe in one's ability to execute an action successfully and achieve the desired goal, increasing motivation (Deci & Ryan, 1985; Sørebø et al., 2009). Chen and Jang (2010) argue that perceived competence is associated with challenges in learning technical skills, and thus, the need for competence is the individual's need to feel capable of functional performance, participation, and achieving one's goals. An end user's belief that they are competent at operating SHT is essential for continued use, will aid in reaching other milestones and endeavors and adds a feeling of involvement (Hew & Kadir, 2016; Tschofen & Mackness, 2012). However, failure to see a task through to the end or not completing a task while using SHT can lead to competence frustration. Doubting oneself when confronted with having to reset or update SHT may also see a rise in competence frustration, especially with people who are not technology savvy.

1.4.4. *Digital competence*

Research into digital competence and its outcome that creates a digital divide has moved on from digital accessibility because even when technology is accessible, differences in digital skills are still apparent and lead to inequalities (Burtch & Chan., 2019; Maurer & Lutz, 2011). In contrast, recent literature exploring digital competence has questioned whether inequalities exist between groups using digital technologies, such as smart home

devices (Vassilakopoulou & Hustad, 2021). Such groups include the elderly (Gródek-Szostak et al., 2021), low-income and less educated populations. They may feel on the wrong side of the digital divide if they cannot adequately use or benefit from the technology (Wei et al., 2011). For example, the elderly are constantly studied regarding their use of information and communication technologies (ICT) and how their lack of use is one cause of the digital divide (Elena-Bucea et al., 2021). There is an argument that some older people are active users of technology, and digital skills vary among the older generations (Klier et al., 2020; Lameijer et al., 2017). However, older generations struggle more with technology and are prone to suffer from technophobia (Elena-Bucea et al., 2021; Van Dijk, 2017) and have difficulties absorbing detailed digital information (Venkatesh et al., 2003) due to a lack of skills (Brauner et al., 2017). Moreover, they are not technological natives and may find it hard to adapt and learn new digital skills, which adds to confusion and anxiety while living in a digital world (Ballano et al., 2014). The study will examine how age is affected by digital competence, technophobia, technophilia and trust and whether these contrasts influence acceptance and future use of SHT.

Contemporary literature has also focused on different competence levels when using ICT and its correlation with the digital divide within society (Robinson et al., 2015). Although digital skills cover a wide range of competence levels, from basic computer usage to advanced Artificial Intelligence programming, most scholarly articles note that having a medium level of competence is sufficient to navigate modern society (Van Dijk, 2017). Various entities use different ways to categorise competence levels of people's digital skills. The education arm of the European Union (Redecker, 2022) has named people with superior digital skills as Pioneers, and people with little or no skills are Newcomers. Digital Skills and the future of work (Commonwealth Secretariat, 2020) also categorises digital skills from basic, defined as having sufficient information and communication technology ICT

knowledge to navigate in an e-economy, to advanced digital competence, defined as specialist skills such as machine learning programming. A study based on the educational framework, the TPACK model, used three skill levels, generic, didactic, and professional digital competence, to measure their participant's digital skills levels.

Consequently, a conclusive singular definition of digital competence is challenging because of the ever-changing nature of technology, culture, and society (Helsper, 2008; Van Laar et al., 2020). The common thread throughout most definitions is the compartmentalisation of skills dependent on the users' needs and outcomes. Some researchers have focussed on technologically deterministic aspects, also known as button knowledge (Bunz et al., 2007; Hargittai & Hsieh, 2012). This approach presupposes a set of digital skills that seamlessly translate to real-world activities such as smart home usage or e-teaching (Admiraal et al., 2016). Nevertheless, such a narrow skills approach has been criticised as being too reductive in design and ignoring technology's socio-cultural and psychological aspects (Lund et al., 2014; Ottestad et al., 2014). Broader abilities within a technological paradigm, such as ways of thinking, working, and learning in the 21st century, are all crucial parts of the digital skills assessment process (Van Laar et al., 2020). Digital skills refer to the ability to use technological devices and include cerebral, technical, methodical, and socioemotional skills (Esteve-Mon et al., 2020). Helsper and Eynon (2013) suggested four broad skill categories: technical, social, critical, and creative skills. The model established by Van Deursen et al. (2014) used the measures tested by Helsper and Eynon (2013) plus their own skill distinction framework. They identified the items, operational (OP), information navigation (NAV), social (SOC), creative (CRE) and mobile (MOB) to measure digital skills. The Van Deursen et al. (2014) scale allows for flexibility of use as it does not incorporate contextual items specific to platforms, technological devices or activities. The shorter five

item scale is advised to use in research projects that need to include a variety of other variables and scales (Van Deursen et al., 2014) as is the case in this study.

1.4.5. *Trust in SHT*

Another key piece of SHT acceptance research is the degree people trust in the technology, a concept that encompasses privacy and security (Aldossari & Sidorova, 2018; Ardito et al., 2022; Schomakers et al., 2021; Shuhaiber & Mashal; Yang et al., 2017). In order to drill down into the different layers of the trust variable, and pinpoint which aspects of trust influence individuals, Cannizzaro et al. (2020) categorised trust into three groups, trust in general, trust in privacy and trust in security. Trust in general investigates how reliable SHT is (competence), data collection norms (benevolence) and consent to use data (integrity). Trust in privacy and security explores the likelihood and impact of our privacy being compromised and privacy breached (Cannizzaro et al., 2020).

The evidence surrounding the important role trust plays in SHT acceptance has been outlined from various sources. Recent technologies and specific events may have contributed to individuals questioning the trustworthiness of SHT. An end-user must trust both the smart home device and the manufacturer before they accept the product (Michler et al., 2019). In the book, Surveillance capitalism (Zuboff, 2020) warns humanity that big tech companies are using our residual data lifted from voice, photos, or leisure activities to be sold off without our consent to other companies who create models and patterns of human behaviour. The danger is that face recognition data used from Smart doorbells and cameras, may be sold off to existing authoritarian regimes, as in China, to be used for unethical governmental activity. Zuboff cites a famous Facebook contagion experiment (Cannizzaro et al., 2020; Khedhaouria & Beldi, 2014) whereby Facebook engineers successfully manipulated the emotions of their users offline through subliminal word manipulation. The two very nefarious conclusions

were that they could manipulate the online experience to change real-world behaviour and emotions and exercise this power by bypassing user awareness.

Moreover, according to whistle-blower Chris Wylie, approximately 80 million Americans were manipulated by Cambridge Analytica during the 2016 election year (Gross, 2019). Googles game Pokémon Go contained a lure module or shadow operation of herding groups of people to establishments (known as footfall) who advertised on the game. Privacy laws do exist in the West via bodies such as the GDPR however, as big tech uses residual data, most of the laws are bypassed. Security and privacy issues are of greater concern, in non-Western countries as there are still no cheques and balances regarding data usage (Pal et al., 2021).

Data-driven environments have consistently caused privacy and security issues within social media (Chung, 2016), telecommunications (Bakir, 2021) or cloud computing (Xiao, 2020) and smart home environments have the same challenges and concerns for the end users. Moreover, contracting state-of-the-art privacy and security measures for the smart home is vital due to the large amount of data generated by wireless sensor networks, multiple interconnected devices and database storage being held on the internet (Zhang et al., 2018). A lack of acceptance of SHT may continue if individual governments do not address the problem. An IoT-rich smart home's purpose is to create a comfortable, convenient, accessible, and enjoyable environment (Park & Kim et al., 2017). The downside is the ever-increasing need to protect, secure, and privatize personal data, which could be sent to servers and third-party entities (Mannhardt et al., 2019; Sovacool & Furszyfer Del Rio, 2020). Solutions from the cyber security sector include using an Identifier Resolution Service (Gomez et al., 2019) to create privacy zones within a household that does not allow camera surveillance and dynamically generated interfaces and smart contracts tailored to the end users' needs (Mannhardt et al., 2019).

1.4.6. *Demographic aspects*

1.4.6.1. *Culture*

Cultural distinction within technology research is evident (Bluszcz & Quan, 2016; Syed & Malik, 2014), especially when adopting Hofstede's (2011) six-point cultural framework, which takes into account the following aspects

- individualism/ collectivism
- power distance
- masculine/feminine roles
- uncertainty avoidance
- long-term orientation
- indulgence

Although not without its critics for being too ambiguous (McSweeney, 2002; Taras et al., 2010), cross-cultural researchers have successfully used and validated Hofstede's (2011) six-point cultural framework within different contexts (Beugelsdijk et al., 2016; Gomez-Lumbreras et al., 2019; Sharma et al., 2021). A study on renewable energy adoption (Higueras-Castillo et al., 2019) used Hofstede's model and concluded that Spain has an intermediate collectivism and a low individualism score and is categorized as between a type I (individualistic) and type 2 (collective) country. Despite the differences, English and Spanish cultures share some characteristics: they are part of Europe, share common international goals and have capitalist economies. Moreover, the cultures frequently interact as Spain is a valued tourist destination for the English and the Spanish go to England for tourism and work. Finally, both languages are influenced by Latin.

Applying the self-determination theory (Ryan & Deci, 2017), Higueras-Castillo et al. conclude that the Spanish may not regard the need for autonomy as such an essential value as

the need for relatedness. Another study comparing British and Spanish cultures found that the British scored very high on individualism (Chepurna & Criado, 2021) which suggests the English in this study will highly value autonomy regarding SHT adoption. Their Spanish counterparts scored low on individualism and high on cooperation and interpersonal skills, implying relatedness again will be valued highly in this study. In yet another study with Belgium and Chinese participants it was concluded that autonomy, relatedness, and competence, are essential nutrients for optimal human functioning (Chen et al., 2014).

Thus, the results from the cross-cultural literature is of interest to the present study through assessing potential cultural differences in SHT acceptance by sourcing English and Spanish participants.

1.4.6.2. *Gender*

Initially, gender was not a consideration for the TAM model, although gender difference-based perceptions were explored (Venkatesh, & Davis, 2000). Venkatesh introduced gender founded on previous psychological research that suggests schematic processing by women and men is different (Bem & Allen, 1974). Initial results showed that men consider PU to a greater extent than women in making their decisions regarding accepting new technology in the short- and long term. PEU was more salient to women after initial training and overtime with increasing experience with the system. In contrast, men perceived ease of use as not so necessary. Subjective norms did not influence men's decisions at any point in time (Venkatesh & Davis, 2000).In contrast, women did consider normative influences at the initial stage of technology introduction and after one month of experience. However, Wang et al. (2009) found that social influence is more decisive for men than women when examining stock trading technology. Moreover, studies indicated that women value ease of use and usefulness concerning their usage of mobile internet services

(Khedhaouria & Beldi, 2014). Others found that men value usefulness more than women (Okazaki & Renda dos Santos, 2012). Mixed research outcomes suggest that the actual technology being assessed has a bearing on the results, and it seems complicated to research technology in general. Also, Morahan-Martin and Schumacher (2007) suggest that women are more likely to become technophobes because of less technological expertise and lower comfort during interaction with technology. Additionally, men are more likely to become technophiles with high technical expertise.

Past research has found that women are more averse to technology than men, which could ultimately make them more vulnerable to technology-related anxiety and technophobia. In these studies, women, compared to men, were found to lean more towards caregiving and people-oriented activities (Diekman & Steinberg, 2013), whereas men tended to be more attracted to things such as cars, mechanics, or technology (Graziano et al., 2012; Su et al., 2009; Woodcock et al., 2012). Within education, boys are assumed to be more interested than girls in fields such as science, engineering, mathematics, and technology (STEM subjects) (Cvencek et al., 2011).

Venkatesh and Morris (2000) summarise the relationship between personal interests and gender roles by stating that men have more interest in using technology for efficient goal accomplishment due to gender role expectations and are assumed to be more task oriented. Their finding is buttressed by Simon and Peppas (2005) who suggest men are more technophilic, exhibit more positive attitudes, perceptions, and interest towards technology than women and have less anxiety toward new technology applications. A more recent meta-analysis confirmed that men still seem to have more favourable attitudes towards technology than women (Cai et al., 2017). Therefore, there is evidence that an individual's attitude and personal interest determines how they interact technology (Vasey et al., 2012).

It remains unclear, why in most studies like Kotzé et al. (2016) females score higher in technophobia than males, and if this is a question of attitudes and interests associated to gender roles. A recent study of 300,000 students in 64 countries (Breda & Napp, 2019) showed that males only marginally outscore females in technology-based subjects such as math, yet females significantly outscore males in reading. The conclusion is that females are equally capable of understanding and dealing with technology as men and are not necessarily phobic towards it, yet choose other areas to excel in.

The socialization of women and men according to gender roles could answer why females shows higher technophobia scores in some studies (Voiskounsky, 2011). As mentioned earlier, according to gender roles, women are assumed to be caring and interpersonally oriented, and submissive (Cuddy et al., 2008; Haines et al., 2016), while men are supposed to be logical, competitive, good in mathematics, assertive and task-oriented (Cuddy et al., 2008; Haines et al., 2016). In this vein, Morahan-Martin, and Schumacher (2007) stated that men more than women learn to perceive the technology as a toy and to use it for recreational purposes. The computer functions as a personal and cultural symbol of masculinity so that women stay away from it since it symbolizes what they are not. The masculine stereotype may proliferate technophobia in women and potentially cause them to question their sense of belonging within the technological world (Good et al., 2012).

Moreover, Brosnan (1998) highlighted that in contexts where technology is not masculinized, there is no apparent variance between sex and psychological differences in aversion to technology. This is illustrated by Snapchat use, which shows 56.4 % female and 43.1 % male users globally (Golishsays, 2022) and Instagram has an equal gender distribution audience (Darko, 2022). However, writing code is still seen as a masculine pastime, with 78.6% of computer programmers being male and 90% male in computer network architecture (Beckhusen, 2016a).

Focussing on individual end users and gender, the digital divide seems to be diminishing, especially for the generations raised on technology (Van Deursen & Van Dijk, 2013). Indeed, SHT use is nuanced and seems to return to normative gender preferences. Females use social-based technology products more than men (Barnhart, 2022; Dixon, 2022; Perrin, 2015) and males are more attracted to task- orientated SHT and goal accomplishment (Venkatesh & Morris, 2000). Selwyn (2007) found that certain technologies are perceived as feminine or masculine: Emailing, e-learning and graphics are seen as feminine technologies, while online banking, laptops, digital cameras, and digital music are perceived as masculine.

Thus, the data, although inconclusive, suggests that more females reject certain technologies due to their stereotypically male image rather than have a fear of technology. Therefore, females may not accept or interact with male SHT, such as thermostats but may accept more feminine SHT, like smart cookers or baby monitors. Females are more likely to accept if SHT reflects their caring nature, provides a social aspect, and if the product is unique or innovative (Baudier et al., 2020; Furszyfer Del Rio et al., 2021). Additionally, females have a proclivity for SHT that secures and protects their dwelling and maintains warmth and a pleasant ambience (Mamonov & Benbunan-Fich, 2020). Females also use SHT to keep in touch with others and garner relationships (Comunello et al., 2017; Furszyfer Del Rio et al., 2021). They also score higher than men when questioned about using SHT for domestic chores such as laundry, cooking and cleaning (Furszyfer Del Rio et al., 2021). Men will be more involved with the set-up, maintenance, and updates of SHT because they view themselves as the technical "czars" or more technically proficient than their female counterparts (Rode & Poole, 2018; Strengers, 2021). Generally, men gain pleasure from tinkering or playing with SHT, which emphasizes their desire for control and mastery of technology (Furszyfer Del Rio et al., 2021; Mennicken et al., 2014).

Sobieraj and Krämer (2020) article examined gender in conjunction with technology acceptance. They cite socialization due to gender roles (Prentice & Carranza, 2002), behavioural and cognitive stereotypes (Aronson et al., 2007) and benevolent sexism (Burgess & Borgida, 1999; Fehr & Fischbacher, 2004) as possible reasons why men engage more enthusiastically with technology. Variables tested by Sobieraj and Krämer (2020) included self-efficacy, social influence, computer anxiety, external locus of control and experience. Their findings indicated that

- Men attributed social influence with greater importance than women.
- Women attribute themselves to lower general computer self-efficacy.
- Women have lower general computer self-efficacy.
- Women possess less control over technology usage than men.
- Women do not experience more anxiety than men.
- No gender difference regarding task accomplishment, with women and men performing equally well in completing the given task

SHT is not a bland, faceless, detached device programmed to serve but a technological instrument that can question gender roles and the roles of males and females within the household (Van der Velden & Mörtberg, 2011). The home dwelling is a space where gendered roles are constantly being challenged, resulting in men's participation in household chores doubling in the last 50 years (Achen & Stafford, 2005). Men's positive attitude towards technology coupled with women's dominant role in the home suggests that gender may not highly affect the study's results.

However, irrespective of marital status, women own smart products and live-in smart homes, and therefore technological design and development should consider distinct gender roles and identities (Richardson, 2007). A significant responsibility for the smart device

industry is to address the design of smart home technologies to incorporate technology use for both men and women "with a wide range of gender identities" (Rode & Poole, 2018, p.10). In other words, the concept that male technology use is normative and female use is secondary needs to be revised (Rode, 2011), especially as women still take on the domestic workload more than men (Gram-Hanssen et al., 2017).

1.4.6.3. ***Age***

The younger digital natives (Millennials, Generation Y and Z) brought up with technology did not experience the shift from the analogue age to the digital world and are unlikely to experience as many barriers to SHT acceptance as the older generations. The digital natives are more comfortable around smart technology and view SHT as beneficial and an excellent long-term investment (Furszyfer Del Rio et al., 2021; Lê et al., 2012).

A large proportion of the literature regarding age and SHT acceptance focuses on how SHT can benefit the ageing process, adding value and dependence to health care technology in the home (Chung, 2017). SHT for the elderly aims to improve well-being, remain independent, create support systems, and ultimately reduce society's healthcare system costs (Alsulami & Atkins, 2016). Leeraphong et al. (2015) highlighted that digital competence and confidence in one's abilities play a significant role in accepting SHT for the older generations. In the Alaiad and Zhou study (2015), patients' belief that SHT can deliver improved quality of life proved to be a critical factor in SHT acceptance. Ambient assisted living (AAL) alerts families or a support centre if a monitored older person does not perform their usual routine in the home. This type of SHT has added a sense of security, independence, and enhanced well-being for people of advanced age (Alsulami & Atkins, 2016; Fan et al., 2017). Research on home-based telecare highlighted the positive role of perceived usefulness for the intention to use SHT (Vadillo et al., 2017). Consequently, the

existing literature shows that SHT can positively influence the more mature sectors of society and improve their daily quality of life.

Despite some promising research which indicates a degree of SHT acceptance, certain barriers are specific to the more mature SHT user. The adage *You can't teach an old dog new tricks,* seems apt for some senior citizens who prefer the traditional way to do chores around the home and thus resist SHT (Peruzzini & Germani, 2014). SHT, especially within the health sector, when used to substitute human interaction, can exacerbate feelings of loneliness and lead to pathologies, including depression and technophobia (Wu et al., 2012). There is evidence that the elderly are afraid they may choose the wrong SHT to satisfy their needs and have problems using smart home devices (Grgurić, 2012; Peek et al., 2014; Peruzzini & Germani, 2014; Sun et al., 2010). A lack of digital skills, inadequate management of SHT and a lack of inclusivity in the digital living ecosystem have been signs that technophobia is a real risk and barrier for the more mature individual (Di Giacomo et al., 2019).

Nevertheless, the argument that the younger generations have unreservedly accepted SHT is contentious. Barriers to SHT acceptance include security, safety, trust, and privacy issues. These barriers are not demographic-specific and can affect the older and younger generations, although the elderly are more susceptible (Pal et al., 2021; Peek et al., 2014). Additionally, SHT compatibility issues and cost caused concern across the demographic spectrum (Arshad et al., 2014; Balta-Ozkan et al., 2013). Therefore, the misconception that the younger digital native cohort has low or no experience of anxiety towards SHT and does not suffer from a form of technophobia has been questioned and proved false by Khasawneh (2022). Furthermore, some older individuals are tech-savvy, and some younger people suffer from technology fatigue (Brauner et al., 2017).

1.5. Relationship between technophobia, technophilia and digital competence

The relationship between technophobia, technophilia and digital skills is salient to the research on SHT because people with low levels of digital competence are more likely to have low levels of self-efficacy, feel insecure and manifest symptoms of technophobia, such as anxiety while using technology, which ultimately affects their technology use. Therefore, individuals with technophobia manifested through anxiety are likelier to have low digital competence due to a low degree of technology engagement (Jung et al., 2010). Individuals who feel confident and show symptoms of technophilia, such as a desire to use technology (Wild et al., 2012), have the confidence to explore and engage with technology and will inevitably gain more digital skills and overall competence, which will increase their use of technology. Self-efficacy, confidence, and belief in one's ability to perform actions are imperative to gain the digital skills necessary to accept and use SHT competently (Myhre et al., 2017).

Research is gradually opening up to the phenomenon that psychological factors like technology anxiety (technophobia) may affect an individual's capacity to learn and improve their digital skills. Previous literature has concentrated on socio-demographic factors to explain why some sections of society embrace technology and others do not. It is undeniable that age, gender, and socio-economic status play important roles concerning technology and SHT use. (Shin et al., 2021). Health inequalities, physical or cognitive, and political inequalities have also been suggested as reasons for strong or weak digital skills (Van Deursen, 2010). Some authors have started to incorporate both technophobia/philia and digital skills to examine technology acceptance, although for the time being no studies have used these constructs in the context of SHT usage or acceptance.

Studies have shown technophobia can be treated by increasing individuals' technology skills through increased technology engagement (Wild et al., 2012; Xie, 2011).

Studies on technology acceptance do state technophobia may predict individuals' intention to use, and the negative correlation between digital skills and anxiety concur that technophobia can be reduced if computer knowledge and the ability to operate technology is increased (Cimperman et al., 2013; Moore et al., 2015). Jung et al. (2010) highlighted a causal relationship between computer anxiety and a lack of interest in gaining digital skills technology usage which ultimately widens the digital divide. The digital divide refers to peoples access to technology, their technological skills levels and frequency of use (Hargittai, 2002; Van Dijk, 2005) However, it must be noted that all the mentioned studies dealt with older populations. This, however, does not imply that the younger generations (the so-called digital natives) are automatically technophilic digital learners and that they can also suffer from anxiety and technophobia (dos Santos & Santana, 2018; Khasawneh, 2022; Korobili et al., 2010; Sánchez-Caballé et al., 2020; Top & Yılmaz, 2014).

Concerning the smart home there is no literature that measures the roles of technophobia/philia and digital competence and skills in conjunction with SHT. A study on the digital divide argues that the acquisition of digital skills may limit stress and anxiety and prove beneficial when operating SHT (Van Deursen & Mossberger, 2018). Other studies within the smart home discourse that discuss digital skills and possible computer anxiety or technophobia target home education or e-health, but do not contemplate smart domestic products. However, taken as a whole, the internal constraint known as technophobia does negatively affect attitude towards learning digital skills and can thus create a digital divide, which then can affect SHT acceptance (Nimrod, 2018). On the flip side, individuals with more enthusiasm for technology will be more open to learn, acquire digital skills, and therefore tend to show a higher acceptance of SHT (Martínez-Córcoles et al., 2017; Osiceanu, 2015).

1.6. Purpose of the present research

Research on the acceptance and usage of SHT is more relevant than ever, as more people are spending a lot more time at home (Sekar et al., 2018) due to recent events, including Covid lockdowns and the increase in working from home (Brynjolfsson et al., 2020). As they spend more of their lives at home, individuals become more likely to contemplate the purchase and use of SHT to make their experiences at home more comfortable and convenient (Balta-Ozkan et al., 2013).

The home environment now significantly influences our psychological needs, actions, and behaviour as individuals. Due to technology advancements humans can now store food and heat their homes. SHT advances the original use of such appliances and now interacts with the homeowner by communicating valuable information such as how much an individual has spent on heating or when food is defrosted and ready to cook. Nothing has changed the way humans interact, communicate, work, and live more so than innovative smart technology and thus, it is more important than ever to critically assess SHT (Maalsen & Dowling, 2020). The biggest challenge in information technology and systems research is understanding why people accept or reject new technology.

Many studies have highlighted the benefits of SHT which on the surface are hard to refute (Sovacool & Furszyfer Del Rio, 2020). For example, SHT does domestic chores which free up time for people to engage in other activities and provides money saving analytical data (Fortunati, 2017).Individuals may presume spending hours using home entertainment systems, as positive by becoming a successful gamer or adept smart phone user, and may ignore its addictive qualities (Beckhusen, 2016b; Carbonell et al., 2018).Therefore a study on psychological factors that affect SHT acceptance may enlighten individuals to possible warning signs that their technological usage needs to be re-assessed. Moreover, it is

important to add to the literature on how and why psychological outcomes affect SHT acceptance as it has been under researched.

It is vital to understand if a household becomes problematic due to SHT acceptance into the home which may provide smart manufacturers and policy makers a greater understanding of how to design and develop products based on people's needs. The present research aims to understanding this area by undertaking two studies that focus on the psychological aspects of SHT. From a theoretical aspect, study 1 will use the TAM a proven model for SHT acceptance and add the SDT as a model to assess psychological needs (in this case, frustration of the needs of autonomy, relatedness, and competence); the role of technophobia is investigated in this context. Study 2 investigates the relationships between technophobia, technophilia, and digital skills and their roles in conjunction within the SHT eco-system. Therefore, this research aims to gain an understanding of the factors that influence the SHT user to provide to reliable guidelines and insights for smart homes providers, manufacturers, and consumers (Shuhaiber & Mashal, 2019).

II EMPIRICIAL SECTION

2.1 Presentation

The theoretical section of the study defined terminology attributed to SHT and outlined the issues regarding SHT acceptance. Furthermore, the section detailed why the technology acceptance model (TAM) with its variables perceived usefulness (PU) and perceived ease of use (PEU) is theoretically adequate and underpins the present research. Crucial elements of the project including technophobia, technophilia, digital competence and basic psychological needs (autonomy, relatedness, and competence, as described by self-determination theory, SDT) were comprehensively explained. The role of demographics (age, gender, and culture) was outlined as was the relationship between digital competence and technophobia and technophilia. The purpose of the study and assessment of the benefits and disadvantages of SHT finalised the theoretical section, namely the varying degrees of SHT acceptance due to individuals' levels of technophobia and needs frustration plus the roles of technophobia/philia, digital competence, and trust within the SHT context.

Study 1 combines two theoretical models, the TAM and SDT, and adds technophobia as mediator variable to examine individuals' reasons for accepting or rejecting SHT. It is of interest to ascertain how both models interact with each other and whether technophobia is a real-world phenomenon that influences the individual decision-making process when deciding whether to engage in SHT.

Study 2 goes beyond intention to use to access SHT acceptance and aims to gain a deeper understanding of individuals psychological perceptions by evaluating the roles and interplay between technophobia, technophilia, digital skills and trust in SHT. Ownership is included as it's a barometer of acceptance. and demographics are also included in the study Ethical clearance

Both studies sourced adults over 18 years old only. The questionnaires exclusively addressed their use of SHT together with their perceptions of needs frustration (Study1) and

the degree of their digital competence based on five digital skill subscales (study 2). Furthermore, the participants' perceived degree of technophobia was also assessed in both studies. Participants were informed about the purpose of the study and about the use of the data they were to provide, by informing them about data protection related to this research. They had to give their informed consent by ticking the corresponding tab. Ethical clearance was obtained previously through the Ethical Committee of FPCEE (reference number: 2021017D). (See appendix A).

2.2. Study 1

2.2.1. A cross cultural investigation on individuals' acceptance of Smart Home Technology: The role of needs frustration

Abstract

Smart Home Technology (SHT) has been available to the public for over twenty years, yet individuals' acceptance and intention to use smart products is still relatively low. This study aimed to investigate the acceptance of SHT using the Technology Acceptance Model (TAM) and the Self Determination Theory (SDT) with a sample of English (N = 284) and Spanish (N= 230) SHT users. A mediation model was established that predicted that technophobia would mediate the effect of the frustration of psychological needs (autonomy, relatedness, and competence) on behavioural intention to use SHT. Technophobia did not act as a mediator, as there was no direct effect of need frustration on behavioural intention; however, technophobia proved significant as a stand-alone predictor of intention to use smart home products. There were no significant gender effects, but there were important differences between the English and Spanish participants, which are discussed in terms of cultural differences in the degree to which need frustration is essential for participants.

Keywords: technophobia; Technology Acceptance Model; needs frustration; Self Determination Theory; Smart Home Technology

2.2.2. Introduction

Although Smart Home Technology (SHT) is widely available, but the complete smart home setup has not been fully integrated into everyday life. It is still uncommon to experience a fully integrated, completely intuitive smart home environment. Despite promising future sales predictions (Mordor Intelligence, 2021; Research & Markets, 2020; Schill et al., 2019; Yang et al., 2018) the relatively low acceptance and modest usage of SHT suggest that SHT may be leaving consumers frustrated and may not be satisfying their needs. Other potential reasons for low acceptance include design flaws, consumer misunderstandings, lack of consumer technical skill (de Boer et al., 2019), pricing (Neumann, 2018) long product life cycles (Yang et al., 2018), privacy issues (Hubert et al., 2019; Van Hung et al., 2021), security concerns (Stoyanova et al., 2020) and compatibility issues within smart home infrastructure (Ricquebourg et al., 2006). Additionally, SHT is viewed as an exclusive luxury item in many regions of the world, which limits more widespread adoption. Moreover, purchasing and sales figures do not automatically equate to continuous or actual use (Shuhaiber et al., 2019) as consumers may have buyer's remorse due to the complexities of using SHT (Marikyan et al., 2019). In addition, an optimistic sales forecast does not necessarily represent SHT's overall rate of acceptance, as groups of affluent technophiles might be buying up the majority of SHT.

Technology companies' business models seem to be based on attracting end users' attention and then selling their data to monetize and profit (Calvo et al., 2020). This leaves little scope for manufacturers to contemplate an aspect that could play an essential role in SHT acceptance: the end user's psychological needs on one hand, and uneasiness related to new technology (technophobia) on the other. The existing literature that addresses SHT

through psychological models overwhelmingly uses the technology acceptance model (TAM). The TAM (Davis, 1989) was created as a reliable model to examine the potential user's behavioural intention (BI) to use a specific technology, and the theory is usually applied in conjunction with another theory or additional variables (Hubert et al., 2019; Liu & Chou, 2020; Mital et al., 2018; Nikou, 2019; Park & Cho et al., 2017; Schill et al., 2019; Shuhaiber et al., 2019).

The TAM clarifies that an individual's attitude, represented by perceived usefulness (PU) and perceived ease of use (PEU), will determine the degree of the behavioural intention to use a specific technology (Davis et al., 1989). Thus, individuals' behavioural intention to use SHT is an affective reaction to the performance of these technologies, which increases if PU and PEU are adequately satisfied.

Self-determination theory (SDT) focuses on the "why," individuals' behave in certain ways of which basic psychological needs is a key concept (Ryan & Deci, 2000).The three basic needs in question are competence (feeling capable or effective to complete an action), relatedness (having a connection or care for others) and autonomy (a feeling of self-governance and control). If these basic needs are not met, feelings of frustration can manifest within individuals.

Purpose of this study

This study will examine user acceptance within a smart home environment based on its potential to frustrate basic psychological needs for competence, autonomy, and relatedness. A lack of fulfilment of the three intrinsic factors related to SDT could stunt human growth and foster frustration, which in turn could lead to the dismissal of SHT, ill-being and even psychopathology (Bartholomew et al., 2011; Vansteenkiste & Ryan, 2013). Individuals could trigger defensive psychological mechanisms leading to frustration and

technophobia if they perceive the SHT environment as controlling or critical of their sense of being (Vansteenkiste & Ryan, 2013).

Very few papers have explained the acceptance of SHT using theoretical models (Kim et al., 2020). The existing literature on technology acceptance indicates that SDT variables are aligned to TAM as predictors of PU, and PEU (Nikou & Economides, 2017), and research has established the two models' compatibility when exploring BI (Lu et al., 2019; Rosli & Saleh, 2022; Tsai et al., 2021). In addition, a study on ICT acceptance confirmed a significant relationship between SDT and TAM (Lee et al., 2015). Nikou and Economides (2017) study on mobile-based acceptance used SDT and the TAM and concluded that BI was significantly attributed to PEU and PU and additionally, the intrinsic variables autonomy, competence and relatedness had a significant and positive effect on PU, PEU and BI.

With respect to SHT, only Daruwala and Oberst (2022) have combined TAM and SDT. Like the studies mentioned above, these authors found that need satisfaction had a direct statistical effect on BI to use SHT. This result seems obvious, as the satisfaction of one's basic needs would enhance the inclination to purchase and use an electronic device, but it raises the question of what happens when these needs are frustrated. The negative impact of a failure to meet a consumer's psychological needs may cause the person to lose growth potential and evoke feelings of vulnerability, ill-feeling and even psychopathology (Bartholomew et al., 2011; Vansteenkiste & Ryan, 2013). In the context of SHT, a negative experience might feed scepticism and cause individuals to reject the devices. Thus, the present study investigates the relationship between the degree of the frustration of psychological needs (frustration of autonomy, competence, and relatedness) through smart devices and the intention to use smart home technology.

Further, this study analyzes the role of technophobia (TPH) within the combined model. Technophobia is defined as an irrational fear of technology which causes varying

levels stress and anxiety and for some a complete abandonment of anything technological (Khasawneh, 2018).Technophobia was integrated into the study because of the exponential growth of technology has already caused a number of negative outcomes for users of established technology like smart phones (Elhai et al., 2017). Therefore, anxiety due to technology will only increase over time as it envelops every part of human existence which includes the home. It is important to study technophobia in different contexts in order to ascertain if this phenomenon should be considered as a psychopathology. Furthermore, understanding technophobia will aid in combatting the problems that arise due to technology related anxiety.

The role of culture and gender will also be addressed in this study. Initially, gender was not a consideration for the TAM model but as the model developed potential gender differences became apparent. results showed that men consider PU to a greater extent than women in making their decisions regarding accepting new technology in the short- and long term. PEU was more salient to women after initial training and overtime with increasing experience with the system. In contrast, men perceived ease of use as not so necessary. Subjective norms did not influence men's decisions at any point in time (Venkatesh & Morris, 2000). PU and PEU may also influence cultures as more digitally literate societies might perceive technology as easier to use and more useful than less digital competent cultures.

Investigating SHT acceptance from a cross-cultural perspective (in English and Spanish populations) fills a gap in the literature and pinpoints the diverse ways societies are transforming in response to the ever-changing world dominated by technology (Wang, 2016). Differing cultural outcomes will be explored through the lens of two European countries, Spain, and England.

As for psychological needs, studies have shown slight variations among the countries, but there is a consensus that these needs are largely universal (Chirkov et al., 2003; Ryan & Deci, 2000). There are reasons to expect cultural differences in our study. Their lesser tendency toward individualism suggests that the Spanish may regard autonomy as less essential than relatedness (Higueras-Castillo et al., 2019). A study comparing British and Spanish participants found that the British scored very high on individualism, implying they highly value autonomy when it comes to SHT adoption (Chepurna & Criado, 2021). Their Spanish counterparts recorded lower scores for individualism and higher scores for cooperation and interpersonal skills, which suggests relatedness will be valued highly.

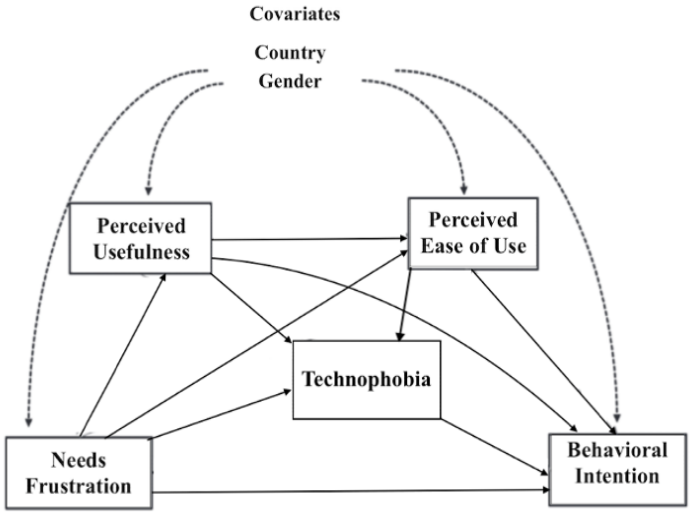
As for gender, Ryan and Deci (2000) conclude that basic psychological needs are the same across gender groups. Yet subsequent studies contain slight variance between males and females when examining psychological needs. An evaluation of basic psychological needs found partial invariance within competence frustration items where men scored lower than females (Costa et al., 2017). The same outcome was uncovered when examining adolescents' well-being (Rodríguez-Meirinhos et al., 2019) while a study on athletes could only partially agree with Ryan and Deci (2000) conclusion. To conclude, possible gender differences may be expected in this study.

To this end, the present study proposes a serial mediation model that includes the variables discussed above. In this model, it is assumed that the frustration of the individual's psychological needs would have a negative impact on the individual's intention to use SHT, and on the perception of the device's usefulness, and therefore would augment technophobia. Usefulness of SHT would show a positive impact on the way individuals' find it easy to use, and therefore, the tendency to use it, would increase. Technophobia, however, would decrease the individual's intention to use SHT. Thus, the model predicts significant correlations between psychological needs frustration (PNF) and BI (H1), PNF and PU (H2),

PNF and PEU (H3), PNF and TPH (H4), PU and BI (H5), PU and TPH (H6), PU and PEU (H7), PEU and TPH (H8), PEU and BI (H9); in other words, it is assumed that PU, PEU and TPH serially mediate the effect of PNF on BI (H10) (see figure 1). In addition, this study examines and expects to find gender and country differences with respect to technophobia, with the hypothesis that females, compared to males, will score higher in technophobia (H11). Moreover, English will score higher than the Spanish in technophobia (H12)

Figure 2.1.

Proposed serial mediation model-Analysis of behavioral intention.



2.2.3. Method

Participants

A non-probability convenience sample of 515 individuals (56% women), with a mean age of 34 years (M = 33.53, SD = 13.448), was recruited online through personal social networks, including Facebook, Twitter, LinkedIn, WhatsApp, and forums dedicated to smart home technology. The participants were living either in the U.K. or Spain.

Instruments

The online battery consisted of an ad hoc questionnaire on demographic data, and type and number of smart home devices owned, and of three scales evaluating psychological need frustration, smart home technology acceptance, and technophobia.

The frustration of psychological needs. An accredited version (Longo et al., 2016) was used and included 9 items that measure frustration of each basic need (autonomy, competence, and relatedness). The items were slightly modified to relate to smart home technology. 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). Examples of the items include:

- Autonomy needs frustration - I feel forced to follow strict directions while using smart home device.
- Competence needs frustration - Occasionally I feel incapable of succeeding in my tasks while using smart home technology.
- Relatedness needs frustration - I feel a bit alone while using smart home technology.

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). The reliability (Cronbach's alpha) of the frustration scale in this study was 0.78.

Technology Acceptance. Technology acceptance was measured using the original scale from the TAM (Davis, 1989). The scale was adapted to relate specifically to Smart Home Technology. It included nine items in total; six items measured perceived ease of use (PEU) and three items measured perceived usefulness (PU). Examples of items used include

- PEU - I find it easy to get smart home technology to do it what I want to do.
- PU - Smart home technology enables me to accomplish domestic tasks more quickly.

Each item was answered using a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The reliability (Cronbach's alpha) of this scale was 0.71.

The scale measuring behavioural intention used by Venkatesh et al. (2012) was incorporated into the TAM scale, yet was adapted to relate to SHT. The scale included three items and each item was answered using a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The reliability (Cronbach's alpha) of this scale was 0.72.

Technophobia. Technophobia (TPH) was measured using the technophobia scale (Khasawneh, 2018), adapted to address SHT. The scale included 14 questions in total that measured different aspects of technophobia (technoparanoia, techno-fear, techno-anxiety, cybernetic revolt, and smart device avoidance)

Items included:

- Technoparanoia - I am terrified that smart home technologies will change the way we live, communicate, love, and even judge others.
- Techno-fear - I am afraid to use some features on my smart home device.
- Techno-Anxiety - I feel restless when I have to learn to use a new smart home device.
- Cyber Revolt - I am fearful that robots may take over the world.

- Smart Device Avoidance - I try to avoid using smart home technologies whenever possible

Each item was answered using a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Cronbach's alpha for the overall technophobia scale was 0.90

Procedure

The questionnaire battery was designed and distributed online via the survey software SOGOSurvey.We surveyed participants using an online questionnaire from April to June 2021. Participants were contacted in their language (either English or Spanish) and received the questionnaire also in their language. Before the presentation of the questionnaire battery, individuals were provided with a consent form that informed them about the research aims and the survey procedure. Participants gave their informed consent by pressing Yes/No tab before responding. 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 only inclusion criterion involved being over 18 years old. The Ethical Committee of the authors' university approved the study protocol.

Data analyses

A multivariate analysis of variance was run to establish possible gender and country differences in the study variables. Pearson correlations were used to check if the variables correlated significantly in the predicted direction. A serial mediation model was used because it is the most comprehensive technique to achieve the results for our path mediation analysis and to go be-yond descriptive to a more functional understanding of the relationships among our chosen variables (Preacher & Hayes, 2004). The statistical significance of the mediation effects of the serial multiple meditation model tested in the study was investigated by using the ordinary least square regression method. Analyses were conducted through SPSS macro-PROCESS v4.1, which allowed us to estimate the indirect effect of successive mediators in a

single model simultaneously. We generated 5000 bootstrapped samples to estimate the confidence interval of the model effect.

2.2.4. Results

Descriptives

A total of 514 respondents (288 females, 224 males, and 2 “other”) completed the 30-item questionnaire battery; the two “other” were eliminated from the calculations. Participants owned an average of 2.7 smart devices; 56.7 % owned two devices (mostly smartphone and smart TV), 25.7% owned three, 10.1% owned four and 7.5% had five. Non-parametric statistics showed that there was no gender or country differences with respect to the number of devices owned. The number of devices owned did not correlate with age negatively with competency frustration (ρ= -.110, p=.012) and technophobia (ρ= -.132, p=.003).

Descriptive statistics for gender and country on the dependent variables are depicted in table 2.1

Table 2.1.

Descriptive statistics (means and standard deviations) on study variables between men and women for UK and Spain nationals

Variables	UK		Spain	
	Men n=87	Women n=197	Men n=125	Women n=84
Overall needs frustration	21.24 (5.99)	20.96 (5.05)	22.78 (5.03)	22.82 (5.32)
Autonomy frustration	7.56 (2.75)	7.24 (2.2)	8.01 (2.22)	8.39(2.34)
Competence frustration	7.60 (.2.64)	7.66 (2.3)	7.72 (2.30)	7.71(2.45)
Relatedness frustration	6.08 (2.12)	6.20 (3.4)	7.05 (2.30)	6.72 (2.11)
Perceived ease of use	21.10 (3.28)	21.10(3.43)	20.15 (3.02)	20.15 (3.19)
Perceived usefulness	9.71 (2.32)	9.48 (2.3)	10.57 (2.20)	10.61 (1.92)
Behavioural intention	11.46 (1.87)	11.41 (2.21)	12.01 (.1.81)	11.88 (1.83)
Technophobia	30.47 (9.98)	32.75 (9.63)	30.22 (8.64)	32.45 (9.81)

Note. Standard deviations are shown in parentheses.

Multivariate analyses

The results of the MANOVA showed that there were no gender differences; the effect of gender on technophobia did not reach significance (F=2.88, p=.057) but could be interpreted as a tendency. However, there were several country differences. UK participants scored higher than Spanish participants on autonomy frustration (F=16.70, p<.001), relatedness frustration (F=18.96, p<.001), overall needs frustration (F= 17.57, p=.001), BI (F= 6.51, p=.011) PEU (F=9.22, p=.003), PU (F= 15.13, p<.001). Technophobia was not significantly different in both countries.

Correlations between the variables can be consulted in table 2.2. All correlations showed significant effects in the predicted direction, so the conditions for the mediation

analysis are given. As country had shown a significant effect on some variables, country was entered as covariate in both models.

Table 2.2.

Pearson's Correlation Analysis on Study Variables

	1	2	3	4	5	6	7	8
1. Overall needs frustration	1							
2. Autonomy frustration	.774**	1						
3 Competence frustration	.800**	.442**	1					
4. Relatedness frustration	.730**	.322**	.390**	1				
5. Perceived ease of use	-.596**	-.424**	-.530**	-.418**	1			
6. Perceived usefulness	-.173**	-.118**	-.256**	-.017	.397**	1		
7. Behavioural intention	-.354**	-.294**	-.340**	-.177**	.463**	.450**	1	
8. Technophobia	.479**	.379**	.378**	.346**	-.377**	-.160**	-.425**	1

Note: * $p < .05$. ** $p < .01$.

Mediation analyses

Regression coefficients for the study variables and the covariate over mediators on outcome were significant, but R^2 was lower than the overall indirect model, which explained a 38 % of the variance ($R^2 = 0.377$; $F (5, 511) = 62.031$; $p < .001$). Table 2.3 and figure 2.2 present the effects of the serial mediation analysis on behavioral intention; beta values are also presented in figure 1. As can be seen, the path from NF to BI was not significant, but the indirect effect was. Also, the path from PEU to TPH was significant, but PU to TPH was not.

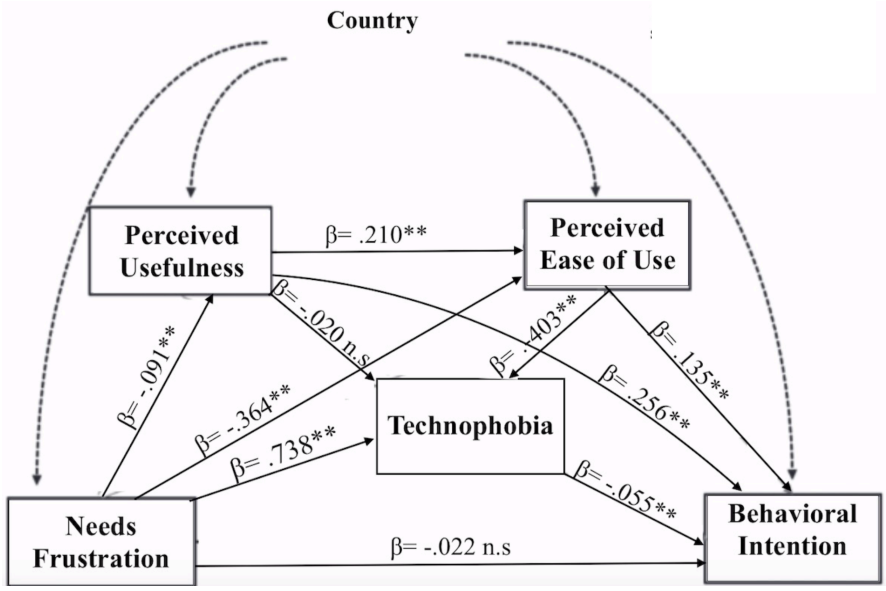
Table 2.3.

Summary of serial mediation analysis of technophobia, PU and PEU between NF and BI

					95% CI	
Effects	Path	B	SE	t	lower	upper
direct	NF→ PU	-0.091	0.181	-5.015**	-0.126	-0.055
	Country→PU	1.181	0.194	6.073**	0.799	1.563
	NF→ PEU	-0.364	0.022	-16.653**	-0.407	-0.321
	PU→PEU	0.210	0.630	3.343**	0.087	0.334
	Country→PEU	0.042	0.0234	0.179 n.s.	0.419	0.503
	NF→ TPH	0.738	0.085	8.672**	0.571	0.905
	PU→TPH	-0.020	0.184	-0.112 n.s.	-0.374	0.334
	PEU→TPH	-0.403	0.149	-2.695*	-0.696	-0.109
	Country →TPH	-2.423	0.765	-3.167*	-3.925	-0.920
	NF→ BI	-0.022	0.017	-1.291 n.s.	-0.057	0.012
	PU→ BI	0.256	0.035	7.345**	0.187	0.324
	PEU→ BI	0.135	0.029	4.638**	0.077	0.192
	TPH→BI	-0.055	0.008	-6.477**	-0.072	-0.038
	Country→ BI	0.343	0.149	2.301 n.s.	0.050	0.636
Total effect	NF→BI	-0.144	0.015	-9.422**	0.191	0.249
	Country→BI	0.787	0.164	4.794**	0.465	1.110
Indirect 1	NF→PU→BI	-0.023	0.006	---	-0.036	-0.012
Indirect 2	NF→PEU→BI	-0.049	0.012	---	-0.073	-0.026
Indirect 3	NF→TPH →BI	-0.041	0.008	---	-0.059	-0.025
Indirect 4	NF→PU→TPH→BI	-0.001	0.001	---	-0.002	0.002
Indirect 5	NF→PEU→TPH→BI	-0.008	0.003	---	-0.015	-0.002
Total indirect		-0.122	0.015	---	-0.153	-0.093

Figure 2.2.

Effects of the serial mediation analysis on behavioral intention.



Note. p**<.001. Line for country not shown for better visibility

2.2.5. Discussion

The mediation model

This study investigated the relational impact and mechanisms at work between the degree of psychological needs frustration through SHT and BI to use SHT, with a combined model using SDT and TAM. Although hypotheses 1 to 9 were confirmed (all correlations significant), the predicted model did not check out fully (H10). Firstly, TPH did not act as a mediator between the PNF on BI, since the direct path between NF to BI was not significant. This is not uncommon, as Cavdar Aksoy et al.(2020) found that technophobia had no mediating effect on effort expectancy and attitude towards smart wearables. Therefore, technophobia may be more effective within a different conceptual model, possibly with specific theories (De Cremer et al., 2017) used to assess technology aversion such as Innovation Resistance Theory (Ram, 1987). Technophobia's lack of influence as a mediator suggests it functions better as a sole constructor predictor. Indeed, as a predictor on its own, technophobia did affect BI negatively, which concurs with past studies (Brosnan, 2002; Khasawneh, 2018; Khasawneh et al., 2020; Mcilroy et al., 2007). Interestingly, TPH was affected by PEU but not by PU, which means that usefulness itself is not a predictor of TPH, but the degree to which a device is easy to use, is. The result is in line with Khasawneh et al. (2020) whose study examining technology acceptance in online classes saw TPH affected by PEU and not PU. The reason may be because it is hard to differentiate PU within technological environments from other constructs and may have embedded itself within other variables, in this case PEU (Khasawneh et al., 2020). Additionally, a study on home online banking concluded that technophobia did not moderate between PU and customer acceptance (Agha & Saeed, 2015). Moreover, a smart devices serviceability, and functionality and overall usefulness does not seem condition technophobia; however, the difficulty in handling or operating SHT does seem to enhance technophobic tendencies. Similarly a person with

aerophobia can see how useful airplanes are but would not board an aeroplane themselves. Modelling usefulness as a source of enjoyment may solve issues with PU when exploring its relationship with technophobia (Dogruel et al., 2015).

As predicted, the effect of needs frustration on behavioural intention was negatively mediated by perceived usefulness and ease of use. Perceived usefulness and ease of use are essential factors that contribute to an individual's intention to use smart home devices, even if the device frustrates basic psychological needs. Therefore, if autonomy, competence, and relatedness are frustrated, an individual's attitude towards the usefulness and ease of use of SHT will be negative. Both constructs (PU and PEU) similarly affect the BI, so when both PU and PEU are significant, consumers are more likely to buy and use SHT. Moreover, the result reinforces the logical relationships that when an individual deems SHT easy to use and useful, they are more likely to be free of fear and have a higher incentive and intention to use it (Ahmad et al., 2012).

Although this study evaluated a range of different SHT, most participants owned a smart TV and voice controller, which may have influenced the findings, as these products are easy to use and require little effort. The basic functions of a smart TV are not too dissimilar to traditional remote-controlled TV, which we are accustomed to using. Meanwhile, using voice commands requires minimal effort and is easier than using devices such as a smart thermostat (Sohn & Kwon, 2020). This may be one reason why PU with PEU positively impacted BI to use SHT. However, on the whole, the participants gave similar positive feedback across all SHT products investigated.

Gender and cultural effects

There was no gender difference concerning technophobia, so both genders seem accustomed to smart technology. This could be because there is less gender division

regarding household chores within the home setting. Gender roles are more fluid nowadays and are realised in relation to differing technologies (Rode & Poole, 2018). As a result, technophobia towards SHT has no gender disparity because as both men and women perceive SHT as a useful piece of domestic technology that can help around the house. A cultural shift has seen women engage more with technology on social media (Perrin, 2015) and within traditional male environments such as gaming, where they now comprise fifty per cent of the gaming sector (Lopez-Fernandez et al., 2019). To conclude, the normative taboos associated with females using technology have been significantly eroded.

Contrary to the results on gender, our study found interesting cross-cultural differences between respondents in England and Spain. English participants scored higher than Spanish participants on autonomy frustration, relatedness frustration and overall needs frustration. According to the cultural dimensions model (Griffith et al., 2000), which divides cultures into Type I (individualistic) and Type II (collective), we assumed that the Spanish culture is more collective and the English more individualistic (Garcia et al., 2019). Autonomy is a need that rests on one's personal choice, volition, and psychological freedom (Tóth-Király et al., 2019) and is based on individuality or an individual's decision-making process. Therefore, the English respondents may have felt more autonomy frustration, as the Type I society has a great sense of personal determination and is more sensitive when their autonomy is challenged.

Furthermore, relatedness frustration could be due to the English participants living in a Type 1 society. Using SHT seemed to increase their lack of connection and association with others (Nikou, 2019), suggesting a lack of support or wanting to reach out to others. Moreover, Type II collective cultures are concerned about building relationships and relatedness, whereas Type 1 societies are more interested in personal dependability (Lee et al., 2013). The Spanish cohort did not feel overall frustration compared to their English

counterparts, and this could also be due to the Spanish lifestyle, which is more laid back and less anxious than the English.

Limitations

The study is not without some limitations. Firstly, as most participants owned a voice controller hub and smart TV, it would be interesting to research SHT acceptance, excluding these two products that have captured most of the smart home market. Moreover, the respondents had relatively few smart devices, with 5 being the maximum in one household.

Secondly, to assess signs of technophobia, more thought could be given to the semantics and word choice of and word choice of Khasawneh's (2018) technophobia scale. Questions such as *I am terrified of being connected to smart home devices because someone might be tracking me* seem abrupt, sensational and at the extreme end of technophobia. Instead, the use of more measured verbs such as *concerned about* or *aware of* may have resulted in technophobia taking a more significant role within the study Furthermore, due to the anonymity of online questionnaires, self-reporting bias and acquiescence when dealing with negative phenomena is a reality that can skew or influence participants' responses. In the future, a mixed-method approach may prove more insightful, especially when dealing with technophobia, or at least a less sensationalistic questionnaire. An alternative method would be to study comparative sample groups living in a fully integrated smart home (Kidd et al., 1999) and examine their behaviour over some time.

Conclusion

The study analysed users' intention to use Smart Home Technology across two countries in Europe, Spain, and England. The differences regarding autonomy and relatedness relate to the UK being a more individualistic society, whereas Spain is more

collective. The finding proved meaningful as the study was not bound to a single country and thus provided a more general look at SHT acceptance and intention to use. Each society gave us a glimpse of human behavioural traits atypical to each country. The implication for SHT manufacturers is apparent, and each product should be tailored to suit the curiosities of differing cultures. Future research could possibly incorporate a single country from each continent to get a more comprehensive general view of SHT acceptance and adoption worldwide.

Our previously unexplored model agrees with the general acceptance that TAM is a viable mediator of SHT's intention to use. The addition of SDT added value to the study by providing psychological factors, which proved that SDT and the TAM, as a combination, can unearth some thought-provoking results. Future research could adopt this model approach and add extra variables such as price, compatibility, and privacy to better assess SHT acceptance and intention to use.

As technophobia is affected by the complexity of SHT usage, which leads to decreased intention to use, manufacturers should take heed and not overcomplicate their products. Smart home manufacturers could use this data to perfect their support systems and create online forums and blogs for users with a necessity to reach out and discuss their smart home products.

2.3. Study 2

2.3.1. 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 and suffer from technophobia, whereas technophilic individuals will embrace new technology. Relying on a study of 243 participants aged 18-65, this study explores the roles of technophobia, technophilia, trust in technology and digital competence and how they interact within the SHT paradigm. The results showed that technophobia correlated positively with age and negatively with ownership and most digital skills. Operational and creative digital skills were critical factors in this context. Technophilia turned out to be a complex construct that was not just the opposite of technophobia. Males outscored females in overall digital competence, especially 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 the operational and mobile digital skills contributed negatively to technophobia, whereas navigational digital skills did so positively. Technophilia-enthusiasm predicted technophobia negatively, whereas technophilia-reputation did so positively. Culture and gender were not significant in predicting technophobia in this context. In a practical sense, there is a need to provide digital skills for all sections of society to increase self-efficacy and counterbalance any feelings of anxiety and technophobia that may manifest within individuals who feel left behind in the modern digital world. The onus is on SHT manufacturers to design products that require basic digital skills and are custom-made for different population cohorts within society.

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

2.3.2. Introduction

Technology is now a fundamental component of modern society. Gradually, cities are becoming more digitised to improve citizens' lives (Rao & Prasad, 2018). In turn, urban dwellers have to embrace new technology to ensure the success of a smart city (Ju et al., 2018). As a result, to successfully manoeuvre in modern society, it is essential to have some knowledge of technological functionality. Consequently, from simple to complex tasks, individuals have to use technology to accomplish their goals. Nowhere is the concept of digitalisation more relevant than in the home. Most governments hope to create fully automatised cities by 2030, in which the smart home is an essential part of the process. (Nicolaides, 2021).

The aim of the smart home is not dissimilar to that of the smart city, to create a safe, comfortable environment based on the 5G grid system and interconnectivity. Smart home technology (SHT) generally works by inter-communicating using sensors integrated into actuating devices that provide data analytics and information over a Cloud computing unifying 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 devices and the user is necessary. However, researchers have questioned if citizens will be able to or want to communicate with technology constantly at home (Reddick et al., 2020; Zhuravlev & Nestik, 2016). The digitally accomplished, digital natives or technophilic individuals will undoubtedly be enthusiastic and make the most out of the smart home. By comparison, a swath of a population who do not understand, distrust technology, and suffer cyber anxiety or technophobia (Khasawneh, 2018) may be excluded from the possible benefits a smart home can bring (Selwyn, 2004), and thus, the digital divide may widen.

Digital competence

There is a distinct lack of research on how SHT is affected by the digital competence. Most articles that explore the relationship between digital competence with 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 do address the association between digital competence and SHT focus on specific products, mainly smart TV (Kennedy & Holcombe-James, 2022) or Intelligent Voice Assistants (IVA) such as Amazon Alexa (Bheemaiah, 2021). The use of IVA has resulted in positive outcomes for people who may feel insecure around technology. Autistic children gain essential life skills such as controlling SHT, ordering the weekly shopping, 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 within 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. Despite their lack of technical competence or old age, the older users reported being more satisfied than their younger counterparts (LG ThinQ, 2021). Although SHT can help less technically competent people in their day-to-day activities, they will still need someone to assist them periodically, as technology is not fail-proof. Hence, a support system must be in place when the technology goes wrong or needs maintenance and updates.

Trust

Regardless of the positive aspects, SHT can be compromised. If trust in a smart device is breached, an individual may not use the SHT and thus contribute to the digital

divide. The fact that IVAs are always listening is somewhat disconcerting and enables malicious attackers to play the role of virtual spies (Chung et al., 2017). The story of a hacker observing and speaking to a three-year-old via a baby monitor should be cause for concern when purchasing SHT (Wang, 2018). Such adverse incidences can lead to a lack of trust and may also cause severe psychological effects and manifest anxiety and technophobia.

Technophobia and technophilia

Specific psychological barriers such as anxiety and technophobia that affect a section of the female population, the elderly, racial minorities, and low-income families have a factorial causal effect on the digital divide (Dijk, 2017). In contrast, the technophilic early adopters, and innovators who are passionate and enthusiastic adoption of technology, especially new technology such as SHT, are on the other spectrum of the digital divide (Martínez-Córcoles et al., 2017; Osiceanu, 2015).

Although a few articles address technophobia and/or technophilia concerning digital competence and the digital divide, no articles explore the topic within the SHT environment. As stated previously, researchers generally examined the older population's contribution to the digital competence by examining it in conjunction with a specific smart product, usually based on e-health (Cimperman et al., 2013). Technophobia 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 inclusion in digital living was deemed inadequate and consequently affected their quality of life (Di Giacomo et al., 2019). Indeed, suffering from technophobia can lead to feelings of societal isolation, a symptom of the digital divide. Notwithstanding, 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, and only once did males showed higher scores than females. Generally, older people suffered more anxiety than the young, highlighting a digital demographic divide, but many papers found no anxiety in the elderly participants (dos Santos & Santana, 2018). Thus, feeling anxious while using a computer is not solely based on demographics. However, it seems to affect females and the elderly more than the young; especially young males are perceived as more technophilic (dos Santos & Santana, 2018).

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

Digital skills are intertwined with technophobia and technophilia. An individual who enthusiastically engages with SHT has the self-efficacy and confidence to use the device even if they are not fully adept at using (Myhre et al., 2017). On the other hand, a technophobe will not gain the necessary skills needed 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

The study aims to go beyond the 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). Specifically, the study aims to clarify which digital skills play a significant role in technophilia. In addition, the structural elements age, culture (Spanish and English), and gender will also be considered within the study. Based on the discussed literature it is hypothesised that there will be a negative correlation between technophobia and digital skills (H1), because technophobic people will deal less with SHT and therefore have less competence (or vice versa). They will also show less trust in SHT (H2), own fewer devices (H3), or have less intention to use them (H4) and are older (H5); there would also be a negative correlation between technophobia and all technophilia subscales (H6); however, two of technophilia's subscales, reputation and dependency have both positive and negative outcomes and therefore it is difficult to predict their influence prior to running the statistical analysis. Although the previous literature on this is inconclusive, we assume that males, compared to females, will score higher in technophilia (H7) and digital skills (H8), whereas females will have higher scores in technophobia. Global surveys show that the Spanish are the one of the most digitally connected societies (Millet, 2020; Rodriguez, 2015) and therefore will be more technophilic (H9) and have greater digital skills (H10) than the English.

2.3.3. 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 personal social networks, including Facebook, Twitter, LinkedIn, WhatsApp, and forums dedicated to smart home technology. The participants were living either in England or Spain.

Instruments

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

Technophobia and technophilia. Technophobia and technophilia was measured using a recently developed scale with an English and a Spanish version (Martínez-Córcoles et al., 2017). This questionnaire was chosen because it measures both technophilia and technophobia, and also the items of the technophobia subscale are less extreme than the ones by Khasawneh, (2018) used in study 1, which allow to look deeper into a broader spectrum of the technophobia phenomenon. The unifactorial technophobia scale consisted of 12 items, e.g. “I feel an irrational fear of new equipment or technology”. Reliability of technophobia in this study was α=.882. According to Martínez-Córcoles et al., 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 of 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” into “smart home technology”. All items were answered using a 5-point Likert

scale, ranging from 1 (strongly disagree) to 5 (strongly agree). As the original scale had presented 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 to reject H0, but the fit parameters (CFI = .865; RMSEA =.081) were not optimal, showing only a trending effect 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.

Trust in the smart home. The trust in the smart home survey (Cannizzaro et al., 2020) consists of 8 items measuring trust in different aspects of trust in privacy, security, competence, and benevolence of smart home devices, e.g. "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 the Spanish participants, the items were translated into Spanish.

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

ranging from 1 (Not at all true of me) to 5 (Very true of me). The reliability of overall the scale was .641.

Intention to use and to recommend SHT. This was measured with 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 gathering took place from April to July 2022. Before presenting the questionnaires, individuals were provided with an online consent form that informed them about the research aims and the survey procedure. Participants gave their informed consent by pressing the Yes/No tab before responding. The questionnaire batch was posted repeatedly on as many online platforms as possible, asking for collaborations in a scientific study on Smart Home Technology. English participants could reply to the questionnaire in English, and Spanish did so in Spanish. The only inclusion criterion involved being over 18 years old. The Ethical Committee of the author's university approved the study protocol.

Data analysis

Descriptive statistics (means and standard deviations), a multivariate analysis of variance (MANOVA) for factors gender and country, as well as the correlations between variables and a regression analysis were run with SPSS 28.0.1.1. (14). For the correlations involving age group, IUR and ownership (number of devices owned) Spearman's rho (ρ) was used, and for the other variables, Pearson's *r* coefficient. Confirmatory factor analysis for technophilia was run with JASP.

2.3.4. Results

Descriptives

A total of 243 respondents (120 females, 123 males), completed the 30-item questionnaire battery. The two "other" 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 depicted in table 3.1.

Table 3.1.

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 group	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.

Multivariate analyses

The results of the MANOVA showed that there were gender differences as males owned more device than females (F=5.85, *p*=.016, η=.025). Males also outscored females in enthusiasm (F=6.78, *p*=.101, η =.029), in overall competence (F=4.12, *p*=.043, η =.018), and creative skills (F=13.30, *p*=.001, η =.056). With respect to county, 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 and gender.

Correlations

Age group correlated negatively with technophilia-dependency (ρ= -.303, *p*<.001), but not with technophobia. Age also correlated negatively with OP (ρ= -.273, *p*<.001), CRE (ρ= -.187, *p*=.003) and overall digital competence (ρ =-.244, *p*<.001). No correlations with trust were found. Ownership was related positively to all three technophilia subscales (enthusiasm: ρ = .341, *p*<.001; dependency: ρ= .430, *p*<.001; reputation (ρ= .275, *p*<.001); negatively but weakly to technophobia (ρ= -.165, *p*=.012) and positively to trust (ρ=.209, *p*=.002) and to OP (ρ=.166, *p*=.012) and CRE (ρ=.291, *p*<.001). IUR only showed a weak correlation (ρ= - .127, *p*=.048) with OP.

There were no correlations between age, ownership and IUR. The other bivariate correlations (Pearson) can be found in table 3.2. As can be seen, the three technophilia variables showed a peculiar pattern: Enthusiasm correlated positively with dependency; dependency was also associated to reputation; but reputation and enthusiasm didn't correlate. Enthusiasm correlated with overall digital skills and all subscales of digital skills, except NAV. Dependency correlated positively with OP, NAV, CRE and overall digital skills, but not with SOC and MOB. And reputation correlated negatively with OP, SOC, CRE, and MOB, and overall digital skills.

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

Table 3.2.

Pearson's Correlation Analysis on 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

* $p < .05$. ** $p < .01$.

Regression analysis

A regression model with technophobia as the dependent variable was adjusted to the data. A stepwise procedure yielded a significant model that explained 57% of the variance (adjusted R^2= 0.565). As can be seen in table 3.3, the operational and mobile skills contributed negatively to technophobia, whereas navigational skills did so positively. Technophilia-enthusiasm predicted technophobia negatively, whereas technophilia-reputation did so positively. Culture, gender, and age were not significant in predicting technophobia.

Table 3.3.

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

2.3.5 Discussion

The aim of the study was to clarify the relationship between digital skills (or the lack of thereof) and technophobia and technophilia. Moreover, ownership and trust was also taken into consideration. The correlations found between the variables allow for interesting conclusions and inferences regarding acceptance and attitudes towards SHT. There were a number of intriguing relationships that add to the existing literature on SHT acceptance and technophobia.

Ownership was related to technophilia, as the more enthusiastic an individual is towards SHT, the more products they owned (Martínez-Córcoles et al., 2017). Differing levels of SHT ownership suggests that owners with multiple smart devices are less anxious regarding technology, a concept supported by the existing literature which showed a negative relationship between ownership and technology anxiety (Chou, 2003). Moreover, avoiding SHT by not owning smart products, may only prolong anxiety as owning and using technology decreases levels of anxiety and possible technophobia (Tekinarslan, 2008). Moreover, it seems logical that ownership levels also correlated positively with trust, as technophilic individuals tend to ignore any negativity surrounding technology, are open, enthusiastic and feel that generally, technology is trustworthy through the perception of normality in use (Mcknight et al., 2011).Additionally, ownership is a commitment and levels of trust-ownership found in the study may be due to these two factors (commitment and trust) working in tandem to positively influence individuals relationships to technology. Trust is gained through multiple interactions and gaining intimate knowledge of SHT which is only achieved through ownership and use (Delgosha & Hajiheydari, 2021). To increase acceptance smart home manufacturers and government should incorporate trust and ownership

mechanisms together 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).

The digital skills that correlated positively with ownership and also contributed (negatively) to technophobia were the operational and creative skills suggesting that individual owners not only view functionality as an important aspect SHT but also using SHT creatively possibly to add to the ambience of a home. One can also infer that SHT creative owners are more ambitious in the products they purchased and bought ambient related products such as lights and speakers. However, navigational skills were associated with higher technophobia. As expected, technophilia-enthusiasm predicted technophobia negatively, but technophilia- reputation did so positively. This allows the conclusion that technophobia, at least as defined by Martínez-Córcoles et al. (2017) does not seem to be the opposite pole of technophilia; first, because the confirmatory factor analysis of the scale was unsatisfactory, and second, because the sub-variables behaved very differently, not only with respect to technophobia, but also with respect to digital competence.

Overall digital competence and its digital skills subscales (except NAV) 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 reputation is based on perception related to one's status rather than an individual's actual level of digital competence. People may have the latest SHT to enhance their technological reputation but may not know how to use the products to an adequate level.

The result with respect to technophilia-enthusiasm concurs with past research which portrays enthusiastic technophiles as more open to gaining knowledge regarding technology

(Ferreira & Oliveira, 2014; Van Deursen et al., 2014). Additionally, a study on enthusiasts of technology devices including SHT, showed that differences between gadget loving individuals are mainly associated with learning how to use the technology and gaining competence rather than motives associated with materialism. In turn, once competence was achieved by improving digital skills, a sense of personal growth was achieved (McManus & Carvalho, 2022). In real world terms, education seems to be vital in order to improve populations general digital competence which could make the technological hesitant or technophobe be more accepting of SHT.

Technophilia-reputation, in change, reflects an individual's joy at having the latest product, an enhancement of their reputation (Martínez-Córcoles et al., 2017). However, the constant need to update and have the latest products can lead to dependency and lead to 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). Moreover, the correlation between technophobia and technophilia-reputation adds to the argument that technophilia-reputation can cause adverse psychological outcomes.

Considering that the majority of day-to-day tasks are dependent on using technology a degree of digital competence is needed to navigate in society (de Souza e Silva, 2017). As technophilic-dependence has negative correlates that can lead to anxiety and addiction, digital competence should not only involve operational, navigational, and functional aspects of technology but also social, 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 ignore the social and wider holistic knowledge base which includes both the negative and positive sides of technology and SHT. Moreover, as age correlated negatively with technophilia-dependency, it is the younger generations who have a less scrupulous attitude towards how to manage their

technology usage and do not associate dependent use as a negative. However, problematic outcomes associated with excessive use of technology have already come to the surface and therefore education in schools plus strong restrictions in the home may alleviate the technophilic dependence for younger people. Additionally, the above recommendations are particularly directed to the Spanish cohort scored higher than their English counterparts on technophilic dependency and digital skills.

Age did not negatively correlate with technophobia however it did correlate with overall digital competence and technophilia, results which are supported by most of the existing literature (Folorunsho & Palaiologou, 2019; Hargittai, 2002; Hargittai & Walejko, 2008). Overall, the younger generations are more likely to be technophilic and use technology than older individuals which creates a digital divide (McDonough, 2016). Moreover, the introduction of smart technology like smartphones and SHT has exacerbated the divide between young and old (Smith, 2020). Reasons why age negatively correlates with digital skills and technophilia include psychic costs, identified as fear of failure, more risk aversion 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, the necessity to stay abreast of the latest technology trends, especially with new technology like SHT, and a readiness to learn new digital skills is imperative for individuals to accept and use and ultimately remain relevant in the digital world.

There were no gender differences with respect to technophobia, but gender differences were apparent insofar as males owned more devices than females which suggests a gender gap within the SHT ecosystem exists. The current literature concurs with the result and explains 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 men own almost 12%of 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 level of computer anxiety (Baloğlu & Çevik, 2008). SHT is still quite task and goal orientated and 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) yet at the same time contributing to the maintenance of a home. In order to encourage more female owners, manufacturers could firstly 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 undertook in the home (Fortunati, 2017). Moreover, SHT should be marketed in such a way to target the needs of different demographics, especially as literature highlights females are more likely to accept SHT if their perceptions are met (Fortunati, 2017; Nikou, 2019).

Males also outscored females in technophilia-enthusiasm which aligns with the existing literature on technoplilia-enthusiasm (Brauner et al., 2017; Furszyfer Del Rio et al., 2021), and creative digital skills. Men are more enthusiastic in their use of SHT due to feeling more protected, empowered and in control (Furszyfer Del Rio et al., 2021) whereas females were less enthusiastic using technology in a study by Brauner et al. (2017). Men do perceive themselves as technology czars and therefore have greater technophilic attitudes then females (Rode & Poole, 2018; Strengers, 2021). Other reasons for men enthusiasm towards SHT have been attributed to gender-role specific socialization (Prentice & Carranza, 2002), behavioural and cognitive stereotypes (Aronson et al., 2007) and benevolent sexism (Burgess & Borgida, 1999; Fehr & Fischbacher, 2004).

These reasons could equally apply to why men also scored higher than females on specific digital skills. Moreover, according to Sobieraj and Krämer (2020) women have lower general computer self-efficacy and therefore are more hesitant in their own abilities to learn

and improve on 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 digitalized information (ITU, 2020). Although data is not conclusion regarding the gender differences within technology, SHT does offer an opportunity for an equality-based environment and women have expressed enthusiasm if they are given the chance to express the feminine side as homemakers, partners and hosts (Strengers et al., 2019).

Finally, technophilia-enthusiasm correlated positively with technophilia-dependency and technophilia- dependency also correlated with technophilia-reputation; but technophilia-reputation and technophilia-enthusiasm didn't correlate. As discussed, technophilia-reputation contains negative outcomes (Beyens et al., 2016; Dittmar et al., 2014) which may have conflicted with the more steadfast construct technophilia-enthusiasm. Although the creators of the technophilia scale Martínez-Córcoles et al. (2017) performed all the necessary procedures before confirming the scales validity and reliability (multi-group analysis, CFA, Cronbach alpha, loading and goodness to fit) they did mention 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. Considering the data of the present study, technophilia-enthusiasm, technophilia-dependency, and technophilia-reputation should be considered as quite different constructs.

CRE, OP and NAV were the most significant subscales when measuring digital skills. The Spanish scored highest on CRE digital skills possibly due to them being the highest users of multimedia, and online platforms in Europe (Millet, 2020; Rodriguez, 2015). 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 scale indicated that their sample indicated that people are least confident with the CRE scale (Van Deursen et al., 2014.) In contrast the CFA highlighted that the sample felt most confident with the OP skills scale which is reflected in this study. Moreover, OP skills or how to use basic functionality represent the baseline for technology use and without it, an individual cannot progress and excel in other digital skills. OP digital skills are the most general type of skills and vital especially when learning how to use and work with technology (Van Dijk, 2005). Whether it is internet or SHT use, OP skills are vital in order to begin to learn how technology works. NAV skills importance in the modern world is due to its comparison with the essentialism of reading and writing (Di Giacomo et al., 2019; Osiceanu, 2015). NAV digital skills are an essential feature of using technology or surfing the internet and one of the first skills to learn is using the mouse to search information online. The MOB skill scale was not as significant which is surprising as it is the most used technology device currently 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 a SEM model. Future research should be careful in selecting appropriate variables to study SHT acceptance and technophobia or technophilia. The cultural perspective could be expanded to represent samples outside of Europe to get a global perspective of the SHT ownership, digital competence, technophobia, technophilia and trust. Research in the future may want to investigate these parameters within a longitudinal framework to evaluate changing perspectives of SHT ownership, digital competence, technophobia, technophilia and trust after the initial purchase of SHT products. Moreover,

adding a mixed method and assessing individuals within a live lab scenario may also expose useful outcomes in real time.

Conclusion

Reflecting on the study main contributions, it was a unique multifactorial investigation, which assessed factors that have either been understudied or not studied at all within the SHT paradigm. Understanding individuals' attitude towards technophobia/philia, trust, ownership, and digital skills has progressed the SHT narrative. The more flexible approach to measuring SHT is innovative and refreshing especially compared to previous research that on the whole utilised established models and theories which for some researchers has reached a dead end (Benbasat & Barki, 2007; Martínez-Córcoles et al., 2017). Another contribution was breaking down and investigation the interplay between technophobia/philia with digital skills and ownerships 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' behaviors when using SHT. Age also proved valuable within the study and the results were in line with the existing literature. Cultural differences did unearth some interesting assertions however future research could examine different perspective from various continents and socio-economic backgrounds.

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

2.4. Overall discussion

Ownership is an indicator of SHT acceptance and, thus, an essential metric in this study. Owning SHT indicates a positive attitude towards innovative technology, that an individual has accepted a smart home device instead of a traditional appliance and that those individuals are willing to use the devices (Cannizzaro et al., 2020). Both studies showed moderate ownership averages; in the second study, individuals owned at least one more device than in the first. This may be due to the larger sample set in study 1, which allowed for more diverse opinions. In addition, study 2 was undertaken one year after study 1, and within that year, SHT became more popular as more people got used to staying at home post-Covid. Moreover, general SHT economic forecasts predict year-on-year increases in SHT purchases which may reflect the results. The difference in ownership could also be because study one correlated with technophobia and competence frustration, suggesting the participants were more prone to negative attitudes towards SHT.

The findings on ownership agree with the existing literature, which concluded that in 2015 there were approximately two connected devices per human; by 2030, this will increase to nine (Safaei et al., 2017). Major audits also stated that between 8% to 11% of the population own two SHTs which highlights that it is still a niche market and suggests acceptance is still low (Deloitte, 2020; Feldman, 2018). Another study highlighted that 50% of the Australian population owned at least one smart home device, yet excessive ownership was not apparent (Dickinson, 2022). Additionally, most owned SHT were products that incorporate a smart system like a TV because manufacturers subsidies the production costs with the expectation of hooking consumers into the automated ecosystems (Gordon, 2020). This implies that individuals are not purposefully seeking SHT yet. Indeed only 5% of SHT

purchases are smart-specific products such as smart lights (Feldman, 2018). Therefore, the results indicate that if the product has an incorporated smart system, consumers view it as a bonus or extra option rather than a deciding factor during purchase or use. If manufacturers gradually ease the production of traditional household products and focus on SHT-based products, ownership and by proxy, acceptance will eventually grow.

Ownership negatively correlated with technophobia in both studies and positively with all three subscales of technophilia in study two**,** which seems logical as technophobia is an irrational fear or rejection of new technology and therefore technophobic individuals are less likely to own many smart home devices (Khasawneh, 2018). In contrast, individuals with technophilic attitudes are more enthusiastic and dependent on technology and view the ownership of technology as a means to enhance their technological reputation (Martínez-Córcoles et al., 2017).

Studies on SHT ownership and technophobia and technophilia are scarce, but the comparative literature does argue that anxiety or technophobia affects ownership. According to Gilbert et al. (2003), the intention to purchase and use technology-related products is mediated by psychological factors such as technology anxiety. A systematic review on computer anxiety flagged eight articles that associated anxiety with technology ownership and access (dos Santos & Santana, 2018). Teo (2006) and Baloğlu and Çevik (2008) noted that technology owners suffered less anxiety than those who did not, implying that technophobia causes avoidance behaviour. Considering phobias are transient and can be overcome by exposure therapy (Binder et al., 2022), it is feasible that owning, accepting, and frequently using SHT is a proven psychological technique to overcome technophobia within the home.

The study also revealed that ownership of SHT was positively related to trust. Trust is a central feature of SHT acceptance therefore individuals with more SHT devices have a

greater trust in SHT (Cannizzaro et al., 2020; Wilson et al., 2017).**).** Therefore, participants who owned more SHT believed that their data was secure, their interested respected, and the SHT satisfied their expectations without manipulating any possible vulnerabilities (Cannizzaro et al., 2020). Moreover, the results suggests that individuals who own many smart home devices accept the element of risk especially concerning privacy and thus their perceived trust outweighs perceived risk (Michler et al., 2019). There is an abundance of existing literature on SHT and trust in which the relationship between end users and data, privacy and security are explored (Aldossari & Sidorova, 2018; Schomakers et al., 2021; Shuhaiber & Mashal; Yang et al., 2017), yet no literature specifically focuses on the relationship between ownership and trust. Although Cannizzaro et al. (2020) do explore both ownership and trust they do not directly correlate the two constructs. Ownership of virtual smart home agents embedded into the smart devices was explored and correlated with trust as participants were suspicious and distrustful regarding who the agents were working for, the end user or the manufacturer (Rodden et al., 2013). Another study on IoT home services correlated social trust with data and the various smart home devices owned however it was not the main thrust of the paper (Bouazza et al., 2022). To the authors knowledge there is no literature focusing on the correlation between trust and ownership therefore the result of this study fills a gap in the existing literature. Using this studies result, the positive correlation between ownership and technophilia, one can presume the trusting individuals were more likely to be technophiles who are enthusiastic, and dependent on SHT and own more home devices to enhance their technoreputation. Research on smartphone ownership has produced some interesting results and therefore more research on established and emerging markets concerning SHT ownership and trust could shed some light on the relatively low acceptance of SHT (Rosenberg, 2020).

In the first study, technophobia was included alongside the TAM, as it may significantly mediate a new and innovative outcome concerning SHT acceptance. Technophobia is an under-researched phenomenon that can affect SHT acceptance, thus substantiating the study.

Of the two variables of TAM, PEU significantly mediated with technophobia. This result is in line with the studies that use TAM and technophobia to examine new technology (Dogruel et al., 2015). The authors conclude that psychological and behavioural barriers such as technophobia are strong predictors of PEU. The suggestion is that if SHT is not overly complicated, there is a greater probability of acceptance and less symptoms of technophobia such as anxiety. However, PEU may have broader ramifications and relate not only to the use of SHT but also to the product's installation, maintenance, upgrades, and operation, which could cause stress and anxiety (Shin, 2009). Chilwin et al. (2020) showed that technophobia also negatively affected ease of use and thus proved to be a significant barrier to using innovative technology. In addition, technophobia significantly mediated PEU for teachers using innovative technology in the classroom (Ahmad et al., 2012). It must be noted that although the studies that examined the TAM with technophobia dealt with new technology, none focused on SHT.

Notwithstanding, the evidence suggests that the processive nature of PEU, which requires a degree of learning to use SHT, should be simplified or at least straightforward to use the basic functionality. The findings highlight that, individuals prefer uncomplicated SHT to fulfil their individual needs and carry out domestic chores with the least effort possible (Schill et al., 2019). This is in line with research on TAM and the intention to use, especially for the elderly (Marikyan et al., 2021) and females (Rode & Poole, 2018; Strengers et al., 2019). Both sets of cohorts want the device to work with little effort and are generally satisfied once it performs its basic functions.

The other primary TAM variable, PU, did not have a statistically significant relationship with technophobia. The implication is that PU is a reliable determinant of acceptance that overrides negative psychological barriers like technophobia. The existing evidence skews towards PU as the dominant variable within the TAM model, and consequently, it remained dominant in this study as technophobia had no influence on it within the path analysis (Hubert et al., 2019; Liu & Chou, 2020; Nikou, 2019; Schill et al., 2019). Having an irrational fear of SHT does not seem to negate people's acceptance that SHT can be a useful addition to the home. Moreover, the body of evidence indicates that PU is a strong determinant of perceptions of the performance-use contingency, user acceptance, adoption, and usage behaviour (Davis, 1989; Davis et al., 1989; Mathieson1991; Taylor & Todd, 1995; Venkatesh & Davis, 2000). Over time, PU remains the significant determinant of BI to use a product as perceived ease of use diminishes in influence. Indeed, once an individual gets past the initial phase of working out how to use SHT, the product's usefulness becomes the dominant factor in whether one accepts or rejects it. Technophobia may affect PU negatively in a longitudinal study as individuals would have more time to assess a smart home product's usefulness.

Cavdar Aksoy et al. (2020) found the opposite results, with technophobia having no mediating effect on effort expectancy (ease of use) but did relate to performance expectancy (usefulness). However, the authors admit their participants may have misinterpreted the performance construct and associated it with their personal performance rather than the effectiveness and performance of the smart technology in question, namely a sports wearable. Technophobia, therefore, did buttress the hypothesis to some extent as it did have a mediating effect on one variable of the TAM, PEU. Technophobia also performed well as a sole construct and, therefore, could be more significant within a more somber context or model (De Cremer et al., 2017), such as Innovation Resistance Theory (Ram, 1987).

Technophobia did not correlate with gender in study one, which could infer that the gender divide within technology and especially SHT is negligible. Evidence supports this result (Qureshi et al., 2009) as male participation within the home has increased (Achen & Stafford, 2005). Moreover, as many SHTs are used for the traditional female occupation of domestic chores (Rode, 2011), just as many females are contributing to SHT purchasing as males and thus negating the viewpoint that technology is still a male-dominated consumer activity. Studies have uncovered that females participate more, whether it be smartphone or social media use, and thus it is viable to assume they are more involved in choosing what products to use around the home (Anderson, 2015). In addition, Yang et al. (2017) research on SHT services identified that their female participants had greater intention to use the services than males.

In addition, it has been shown that SHT liberates females from the traditional housemaker role, allowing them to regain their subjectivity and agency as SHT substitutes and does the work that females previously did (Fortunati, 2017). Therefore, it is not surprising that a significant European survey discovered that females are more appreciative, accepting, and open to using robot machines for domestic usage than men (European Commission, 2014). Apart from injecting a degree of freedom for women to free up time to pursue other activities, SHT provides a supporting role as they alleviate the pressure running and maintaining a household can create. The challenge is to design and manufacture SHT products adapted to meet the needs of various demographics, including women and the elderly (Fortunati, 2017). Indeed, the necessity to meet gendered needs was expressed by Nikou (2019), whose study concluded that females are more likely to accept SHT if their perceptions of variables such as cost, and usefulness are met. Likewise, to increase interest and acceptance, the advertising and marketing of SHT should relay positive messages directed at the needs and beliefs of different demographic populations (Perri et al., 2020).

Despite some encouraging results indicating the gender gap is reducing within the SHT environment, the results of the second study indicate males owned more SHT and scored higher in overall digital competence. The result aligns with several studies that still show men accept SHT more readily than women and use the technology more (Brauner et al., 2017; Furszyfer Del Rio et al., 2021). Although to a lesser extent nowadays, the home is still socially, historically, and culturally gendered (Pink, 2006). Men still consider themselves technically more adept than females (Gram-Hanssen et al., 2017). Men owned more SHT possible because they believed the products were a type of replacement for the traditional housewife (Strengers & Nicholls, 2017).

Additionally, in the qualitative study by Strengers and Nicholls (2017), men took the lead when planning, deploying, and build-up of SHT in the home, which buttresses the argument that males view themselves as technological czars (Rode & Poole, 2018; Strengers, 2021) who like to play and tinker with technology (Gram-Hanssen et al., 2017). The females appeared to take a passive role and were happy for the men to take control of SHT implementation. Ultimately both the men's and women acceptation were optimistic as they could view the benefits of SHT (Strengers & Nicholls, 2017). Applied to a practical setting, it would be interesting to study and compare single males and females and couples to gain a deeper understanding of the gender divide within the SHT paradigm.

This study also saw men score higher than women in technophilia-enthusiasm. The result concurs with the existing literature, which correlates enthusiasm with SHT acceptance and adoption, stating that highly enthusiastic attitudes embrace SHT, whereas the very reserved do not. (Brich et al., 2017; Strengers & Nicholls, 2017). Enthusiasm is a sub-item of technophilia and is primarily related to new and innovative technology that is viewed as a friend rather than a foe by the individual (Martínez-Córcoles et al., 2017; Osiceanu, 2015). Consequently, the enthusiastic technophile has more probability of advancing their skill

development, employment generation and general success in the digital world (Jahan et al., 2021). Men were the most enthusiastic and thus more technophilic regarding the acceptance of SHT, and in a practical setting, they adapted easily to the social changes brought by technological innovations (Osiceanu, 2015). Men found to be more technophilic in this study is congruent with past research, which argues that men are generally more favorable towards new technology than women (Graziano et al., 2011, 2012; Su et al., 2009; Woodcock et al., 2012).

Men's enthusiasm may manifest from their trust of technology as the study showed a positive correlation with trust and technophilia-enthusiasm. Trust and enthusiasm work symbiotically, trust breeds enthusiasm and vice versa. The trust to enthusiasm correlation has been examined in other acceptance fields. An investigation into automated vehicles (AV) supported the studies finding that the more enthusiastic users were the most trustworthy toward AV data collection. In two studies on mobile commerce acceptance the authors concluded that, consumers demonstrate a lack of enthusiasm in acceptance, due to a low level of trust (Joubert & Belle, 2013; Rind et al., 2017). The onus is thus on manufacturers to make fully transparent SHT and ensure that the end users can use the devices without any hidden costs or residual data being sold on to third party organizations.

The papers findings indicate that technophobia showed a negative correlation with technophilia-enthusiasm. This is in line with Donat et al. (2009) who refers to the lower end of technology enthusiasm as technophobia and Seebauer et al. (2015) who suggest feeling of low enthusiasm may negate any feelings of openness toward technology. The development and validation of an instrument to measure attitudes and enthusiasm resulted in a good fit between techenthusiasm and techanxiety (Anderberg et al., 2019) thus supporting this study's results. Technophobia and technophilia are polar-opposites, two extremes of the human to technology relationship, and with enthusiasm used to define technophilia then the study's

finding seems reliable (Martínez-Córcoles et al., 2017; Osiceanu, 2015; Seebauer et al., 2015). However, it is possible for individuals to manifest both technophile-enthusiasm and technophobic anxiety for SHT due to a basic positive attitude towards technology yet also being conscious of its limitations (Anderberg et al., 2019). Such paradoxes are already apparent in social media and video game use (Brambilla et al., 2022).The independent association between technophilia-enthusiasm and technophobia needs to be shown in further studies however the result of the study is a positive step towards unearthing reasons why SHT acceptance is still relatively low.

Technology reputation or technoreputation (Martínez-Córcoles et al., 2017) correlated positively with technophobia. Technology reputation is a strong indicator of SHT acceptance as it concerns individuals who want the latest technology and updates. There is little to no existing literature on technology reputation as it is a new concept (Martínez-Córcoles et al., 2017). People concerned with their technology reputation are defined by their openness to change, flexibility and enthusiasm for experimentation (Coulthard & Keller, 2012). The results showed that the Spanish valued technological reputation the most and were also more technophilic. Thus, technophiles believe their need to purchase the latest technology as a way of improving their lives as they remain abreast of advancements in the technological world.; however, this study indicates the flip side of technoreputation as it can cause anxiety which could lead to technophobia. Indeed, people with technoreputation are prone to obsessive purchasing of the latest SHT, which indicates hyper-acceptance of technological products. This obsession can cause financial strains. Their desire to remain technologically relevant can lead to anxiety and a fear of missing out on the latest SHT, especially affecting the younger generations (Beyens et al., 2016; Martínez-Córcoles et al., 2017). Moreover, they might be enhancing their technoreputation simply for status signaling or materialistic values, which can decrease happiness, life satisfaction, and well-being (Dittmar et al., 2014). Yet again, one

can observe technophilic behaviors leading to technophobic symptoms and the type of people willing to queue up outside a store for hours to purchase the latest technology device should be informed that their pursuit of high status technoreputation can also cause severe problems both financially, psychologically, and physically.

In contrast technophobia correlated negatively with all digital skills except navigational skills. The importance of having a degree of technological competence to navigate successfully in modern era has been compared to the essentialism of reading and writing (Di Giacomo et al., 2019; Osiceanu, 2015). Moreover, having sound traditional literacy skills translate to better understanding and competence in technology (de Boer et al., 2019) and therefore people with lower income and poor access to education are often cited as having negative attitudes or anxiety towards technology (Hong & Cho, 201; Nimrod, 2018). The finding is consistent with existing literature which highlight how using new innovative technology can lead to psychological frustration, anxiety, and technophobia (Di Giacomo et al., 2019; Subero-Navarro et al., 2022; Xun Liu et al., 2021;). Yet the correlation technophobia-digital skills has not been examined within the SHT space which adds to the uniqueness of the study. Technophobia is mentioned in passing in some SHT literature (Sanguinetti et al., 2018) and Parag and Butbul, (2018) did use a sample cohort defined as non-technophobic yet technophobia was not assessed. Only one paper addresses all three constructs, competence, technophobia and SHT and concludes that if individuals feel competent using technology, they are more likely to accept SHT (Daruwala & Oberst, 2022). As SHT becomes more pervasive, more scientific literature may address the issues of digital skills and technophobia but the comparative literature teaches that digital literacy must be addressed as it augments technology acceptance and will prevent the even deepening digital divide (Van Deursen et al., 2014). The result suggests that technological and social norms from the past are still present and probably will remain for some time.

This study is in line with previous research that suggests the more technophilic an individual, the more trust they have in technology (Dzindolet et al., 2003; Mani & Chouk, 2016; Michler et al., 2019; Shuhaiber & Mashal, 2019; Wilson et al., 2017). The Spanish were more technophilic and had a positive relationship with trust. Trust, in general, is an emotional outcome towards a product. As Spanish had more trust, they might believe they are still in control of the SHT and could interrupt the autonomous nature of SHT when necessary (Rijsdijk & Hultink, 2003; Wilson et al., 2017). They appear to have faith in SHTs potential not to misuse data as they gather personal information about themselves and their home and store it in a secure database (Wilson et al., 2017). The fact that the majority of technophilic enthusiasts were males could be because they have a more relaxed laissez-faire attitude towards trust, privacy. A more relaxed attitude to SHT privacy issues is a common feature of male SHT users as reported by Vodanovich et al. (2010) who states that younger male users are less cautious with their privacy and data and confirmed by Aldossari and Sidorova, (2018). As SHT is still in its infancy and constantly changing, males may also believe it is too early or too complicated for cybercriminals to hack their systems.

Moreover, taking the premise that more complicated and autonomous SHT create higher risk as they are more susceptible to errors (Rijsdijk & Hultink, 2009), male's greater trust and consequent greater SHT acceptance may also be because they downplay SHT complexity due to their perception that they have more technical know-how than females or the older generations. They are unconvinced that their privacy and security will be breached, or if breached, the consequences are low and negligible (Cannizzaro et al., 2020).

Issues with trust and studies indicating levels of distrust are available, and with growing evidence of historical breaches of privacy (Dabbagh & Rayes, 2016; Poudel, 2016; Schomakers et al., 2021; Zuboff, 2020), a degree of skepticism regarding manufacturers efforts to protect end users is warranted. With data being touted as the new gold (Angwin,

2010) it is unsurprising that studies discover that intention to use and acceptance is negatively correlated with SHT companies allowing personal data to be stored and possibly sold to third-party organizations (Cannizzaro et al., 2020; Zuboff, 2020). The technophiles seem unperturbed by security issues that can cause anxiety and even lead to psychological and physical risk (Cannizzaro et al., 2020). To negate distrust and increase SHT acceptance, companies must address security issues they are aware of yet ignore and sell to the consumer (Ahmad et al., 2019). Moreover, these security flaws may not have immediate solutions (Yu et al., 2015), which could increase fears when dealing with technology and leave the end user vulnerable (Schomakers et al., 2021).

The Spanish scored higher than the English in technological dependency. According to Martínez-Córcoles et al. 2017, dependence is a negative emotional state prevalent in technophiles due to their repetitive and consistent use of technology. 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). Dependence on mobile phones has its phobic term, nomophobia, which affects 40% of the world's population (Archer, 2013; Mak et al., 2018), and therefore there is a sense of irony as technophiles exhibit underlying symptoms of technophobia. Dependance in the smart home has yet to be examined in depth, possibly because it is not as ubiquitous or socially invasive as other smart products. However, the SHT literature agrees that dependence could cause severe effects on human behaviour and could lead to the 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 other "non-essential luxuries" (Wilson et al., 2017) within the home.

As technophilia-dependency correlated negatively with age it is the younger cohort that are more dependent than the older population. The finding agrees with the existing literature as technophilia was verified as a determinant of intention to use and more pronounced in younger participants (Seebauer et al., 2015). For the older individuals the gradual deterioration of the senses such as sight coupled with the small size of smart devices and their buttons cause acceptance obstacles which contribute to a lack of dependence (Wang & Wu, 2021). Consequently, technological anxiety and technophobia which are more prevalent in older individuals (Van Dijk, 2005) could have influenced the results, as rejecting, or using technology sparingly signifies a lack of dependence (Faloye et al., 2022; McDonough, 2016; Nimrod, 2018). The lack of dependency for the more mature section of society is multifactorial also due to apathy and privacy concerns (Coelho & Duarte, 2016).

For the younger generations, the dependence and consequent overuse of smart technology can lead to various physical and psychological ailments including SHT and gadget addiction (Kumar & Sherkhane, 2018; Supanet, 2017). Individuals who purchase the latest smart home device are more likely to continue automating their home and continuously upgrade (Ross, 2021). 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 establish smart mediums including the smartphone and internet use (Buabbas et al., 2020; Kumar & Sherkhane, 2018). In practical terms, this signifies each individual taking responsibility for their SHT usage and self-regulate to avoid dependence and its adverse outcomes.

Moreover, the study's result that the Spanish are more technologically dependent than the English is in line with the existing evidence, as the Spanish are the most hooked on SHT and technology in Europe. A Technomic Index, which included SHT, commissioned by the EU and Samsung, 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 Spain 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)

Technophilia-dependence and technophilia-enthusiasm correlated positively with digital competence. The literature suggests the positive alignment between technophilia-dependence and digital competence maybe due to a social dependence and needing an acceptable level of digital competence to complete everyday activities such as shopping, paying with a mobile phone or setting a smart thermostat (de Souza e Silva, 2017). Additionally, the pressures of keeping up to date and learning new digital skills to be able to operate innovative technology such as SHT creates a dependency for individuals (Mak et al., 2018). Indeed, as more people use SHT to work from home individuals are obliged to upgrade their own digital skills and knowledge to avoid becoming obsolete or replaced (Tarafdar et al., 2011). Future research should delve deeper into the relationship between technophilia-dependence and digital skills. Dependence creates negative outcomes such as technostress and addiction that could be overcome if digital competence and skills goes beyond understanding and using technology but encompasses learning and coping strategies to counteract the negative (Mak et al., 2018).

Concerning technophilia-enthusiasm positive correlation with digital skills, possessing a positive attitude (enthusiasm) towards technology denotes a desire to have the know-how (digital skills) and expertise to use with a degree of efficiency. The empirical evidence indicates that enthusiasm breeds a desire to learn and gain more skills (Fannakhosrow et al., 2022; Hwang et al., 2021). The study's result is supported by an article on smart e-Services and Social Networks that concludes its more enthusiastic participants were keen to gain a greater knowledge on how to use the technology (Elena-Bucea et al., 2021; Quan-Haase et al., 2016).In addition a study on digital media usage stated that the enthusiastic individuals were the skilled adopters of digital media, thus correlating the two concepts (Livingstone et al., 2017).Therefore the studies result is in agreement with the digital skills and competence literature that professes that it is the early digital adopters and technological innovators who are the enthusiastic technophiles who have a large thirst to gain as much knowledge and as many skills as possible (Ferreira & Oliveira,, 2014; Van Deursen et al., 2014).

By way of contrast technophilia-reputation correlated negatively with OP, SOC, CRE, and MOB, and overall digital skills. The result implies that individuals blindly purchase new innovative technology solely to enhance their status without having the adequate knowledge of the product they are buying.

The Spanish also felt more competent than the English participants using technology and thus more likely to accept innovative SHT. They particularly excelled in operational and creative technology skills. The reason for this result may be due to their more technophilic attitude. Therefore, the more competent participants felt they had the technical and operational ability, skills, and knowledge to achieve certain goals while using SHT (Blumberg & Kauffeld, 2021). Their confidence in their ability to act and react to technological situations suggests they are more willing to accept SHT as they perceive very

few barriers when using innovative SHT. Indeed, the positive relationship between acceptance and higher levels of competence has been verified in the existing literature (Aguiar et al., 2019). In addition, as the Spanish may believe they excel in creative skills because they are the highest consumers of online material spending time watching and making videos and multimedia (Aznar-Díaz et al., 2020).

However, the bulk of the existing literature on digital competence focuses on e-learning (Perifanou et al., 2021) industry (Van Laar et al., 2020) and internet use (Van Deursen & Van Dijk, 2011). Digital skills and competence are mentioned concerning how digital competence may create a gender-based digital divide within the home (Furszyfer Del Rio et al., 2021; Li et al., 2021). Another study was in line with this study as they concluded that having competence and adequate skills to use IoT increased acceptance and adoption of SHT (Jahan et al., 2021).

Moreover, a study examining the effect of skills on SHT acceptance supports this paper's results, namely that digital skills aid in SHT uptake (de Boer et al., 2019). Therefore, increasing one's digital skills plus manufacturers offering online learning and customer support could be vital factors in increasing SHT acceptance.

Age also correlated negatively with digital competence and most significantly with operational and creative skills. Operational skills are the most general type of skills and vital especially when learning how to use and work with SHT (Van Dijk, 2005). Creative skills could be useful when designing a smart home set up. The results align with the existing literature as older generations have trouble using technology because, unlike the young, they were not born within a digital world and therefore by default, are less competent (De Haan et al., 2002). Age negatively correlated with the results of a study on smart cities which incorporated and measured SHT (Shin et al., 2021). The authors warn of the digital or grey divide which can leave the more senior population feeling disenfranchised within society and

disadvantaged in their day-to-day life (Faloye et al., 2022; McDonough, 2016; Shin et al., 2021). In addition, as individual working memory and reaction time decreases with age it is a greater challenge to learn and acquire new digital skills such as operating new SHT (Boyd & Bee, 2019). However, once older individuals begin to use SHT, touch screen and other digital devices can be employed to help the elderly enhance their cognitive function, processing speed and short-term memory (Wang & Wu, 2021). A study using an extended version of UTUAT also highlighted how age negatively correlated with BI (Niehaves & Plattfaut, 2014). Additionally, Niehaves and Plattfaut (2014) unearth a mini digital divide gap between the younger and older individuals within their elderly sample which suggests senior citizens are not a homogeneous group regarding technology adoption. Having sound digital skills are associated with the skills needed to operate the IoT (de Boer et al., 2019) and therefore senior citizens can bridge the divide though education and encouragement from younger family members (Khvorostianov, 2016; Nimrod, 2018; Quan-Haase et al., 2016). The digital feedback from young to old will help increase senior citizens integration into the digital world (Wang & Wu, 2021). By infusing technology into activities enjoyed and practiced by older generation could also see them improve their digital skills, promote digital integration, improve social connections, and alleviate the sense of loneliness (Lee & Kim, 2018).

Country differences were also unearthed in study one regarding frustration. The English participants scored higher than the Spanish on autonomous frustration and relatedness frustration and thus topped the overall frustration score. Concerning autonomous frustration, the participants felt less inclined to accept SHT because of a lack of choice and a feeling of losing control while using SHT. The reason could be that the English possess a greater sense of autonomy and individualism and thus feel more threatened by SHT than their Spanish counterparts (Chepurna & Criado, 2021; Hofstede, 2011). Also, the English were less technophilic than the Spanish and thus more aware of the possible adverse outcomes of

SHT. Additionally, frustration may be due to the lack of transparency from SHT manufacturers who should divulge vital information to end users, such as what data is being collected, with whom the data is shared with, and how the end user can change settings related to data sharing (de Boer et al., 2019). Self-monitoring technologies such as SHT have caused distinctive, varied, and contentious outcomes, highlighting how it may either assist in an individual's autonomy or, inversely, be conducive to greater control and surveillance over individuals and thus undermine autonomy and acceptance (Sharon, 2016; Wannheden et al., 2021).

Concerning relatedness frustration, the English did not feel SHT could connect or bring them closer to others. The reason could be cultural differences, as the Spanish view relatedness as an essential value, whereas the English do not (Higueras-Castillo et al., 2019). Furthermore, the English may be more literal in their use of SHT and view the technology as serving a specific purpose (to save energy or clean the floor). They are possibly unaware that SHT has a large ecosystem based on forums and blogs where people can communicate and discuss their experiences with SHT. Moreover, the English, perhaps, are unaware of the sharing functionalities and possibilities of SHT that allow communication with friends and relatives. (Tabassum et al., 2020).

Limitations and Conclusion

Although self-reporting questionnaires have several advantages, their limitations may have affected the results of both studies. Participants may be prone to social desirability bias (Demetriou et al., 2015) and thus respond to questions that they perceive as socially acceptable (Krumpal, 2011). However, techniques regularly used by researchers to counterbalance social desirability bias, including the randomization of items and confidentiality assurances given to the participants, were incorporated into the studies

(Larson, 2018). In conjunction with measuring digital competence, individuals have a proclivity to over or underestimate their actual skill levels (Van Deursen & Van Dijk, 2010). Despite the possible inaccuracy in measuring digital skills, the study results align with existing literature and, therefore, are appropriate and serve as a strong starting point correlating SHT acceptance with digital competence. To get a deeper understanding of SHT acceptance in study one, frequently used and popular variables with meaningful correlations, including compatibility and Price/Cost, could have been incorporated into the study. More studies within HCI and consumer psychology are needed to pinpoint the mechanisms that drive individuals to accept and adopt SHT and investigate what potential behavioural and psychological interventions may have to increase (Carthy et al., 2020). Finally, a living lab using real-time techniques to measure stress levels, such as Salivary Biomarkers (Chojnowska et al., 2021), could assess satisfaction, frustration and technophobia levels while using SHT give the study a physiological element which would add weight to both the studies.

2.5. References

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Appendix A

Study Information Sheet

Study title: Live Smart: A cross-cultural investigation of smart home technology evaluating acceptance and the role of digital competence, needs frustration, technophobia and technophilia**.**

Locality: Barcelona.

Researcher: Neil Daruwala

Supervisor: Dr Ursula Oberst

You are invited to take part in a study on Smart home Technology, as part of the investigator's doctoral thesis at Ramona Llull University (Blanquerna Faculty of Psychology, Educational Sciences and Sports).

Participation in the study should not exceed 20 minutes.

A total of 43 statements will be presented to all participants which will require one answer from a from options -Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

The purpose of the study is to understand the psychological relationship between humans and smart home technology.

How acceptance of smart home technology affects our behavioural intention to use the smart devices Can Smart Home Technology affect our psychological state and cause anxiety, or a loss of personal self-determination. Moreover, is there a correlation between digital skills, technophilia, technophobia and trust within the smart home technology paradigm.

Whether you take part is your choice. If you do want to take part now, but change your mind later, you can pull out of the study at any time.

The voluntary nature of participation, including that they are free to decline to participate, or to withdraw from the research at any practicable time, without experiencing any disadvantage.

The participant will be instructed to choose a personal identification number in order to protect their anonymity as confidentiality of individuals is

paramount.

The study, once finalized, will be available to any participants by contacting the lead researcher. In accordance with the General Data Regulation Addendum, all data will be privately secured under European law. Participant data will be kept confidential and used only for the purposes of this research. The data will be treated according to Royal Decree 1720/2007,which approves the Regulations for the development of the Organic Law on Protection of Personal Data (15/1999).

For more information, please visit the following link: https://sogosurvey.com/gdpr-compliance.

All participants have the right to contact the researcher if they require to see the final article. If you have any questions, concerns or complaints about the study at any stage, you can contact:

Neil Daruwala, Researcher: neild@blanquerna.url.edu

Consent Form

Please answer Yes or No to the following statement

I declare that I have received information about the study for which my participation is requested. I have been informed of all aspects related to confidentiality and the data protection, that my participation is completely voluntary and that I have the right to withdraw at any time. Therefore, I give my consent to participate in the study and my data can be managed preserving my identity and privacy at all times. Yes / No.